RAILROAD GAZETTE

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Contributions.

The Signal Engineer.

To the Editor of the Railroad Gazette:

The editorial on "The Signal Engineer" coincides exactly with my ideas as to the possibilities in that line of railroad work. In fact, I go further than the article, in that I believe that a really competent Signal Engineer should have such ability and knowledge of traffic as would prevent his being a Signal Engineer on account of his value as a traffic and operating official. The legitimate conclusion of this idea would be that our highest operating officers ought to be fairly expert in the matter of signaling.

CHIEF ENGINEER.

The Training of Machinists and Foremen.

To the Editor of the Railroad Gazette:

Since reading your account of the last meeting of the American Society of Mechanical Engineers in New York (Railroad Gazette, Dec. 15) I have examined more closely Mr. M. P. Higgins' paper on the "Education of Machinists, Foremen and Mechanical Engineers." It seems surprising that, although Mr. Higgins says repeatedly that the object of the half-time school and real shop is first of all for purposes of education, we are told only about the financial results of the twenty-seven years' working of the Washburn Shops of the Worcester Polytechnic Institute, and the more recent school in Georgia. What has become of the young men who have attended this school at the average rate of 95.11 for twenty-seven years, and 167 for the last six years? Is not here to be found the real measure of the success or failure of such a plan of instruction? How many, if any, of these graduates went directly from the school to shops as full paid machinists or foremen? How many of the early graduates are now in positions of responsibility which they could possibly not have reached without this special training? It is hoped that Mr. Higgins will be able to tell us something about this side of the question.

What Mr. Higgins says about the need of skilled machinists and the scarcity of suitable foremen may have applied very aptly a few years ago and still applies to a considerable extent in smaller shops remote from the great manufacturing centers, but this demand is perhaps overestimated when large modern shops are alone considered. In the future the position of foreman should be a less difficult one to fill, and the demand for machinists with sufficient skill to do a great variety of work is in general bound to decrease. The use of automatic machinery and the piece-work system are of course responsible for this change. Under the conditions now prevailing in the most successful shops, it is not an uncommon thing for so-called skilled mechanics to be found performing some simple operation day after day because better wages can be made. It must be said, however, that such a one is often a dissatisfied man, and when he is gone the place is quickly filled by a laborer who in a surprisingly short time is able to do as much and as good work as the skilled mechanic. This second man has so bettered his condition that he is a cheerful workman, and is not continually making trouble.

Also, under the piece-work system the duties of the foreman are entirely changed and the successful working of the shop no longer depends so largely on his individual ability. Under the day system one of the hardest duties of the foreman is to keep every one working, but with piece-work this is reversed, and if anything occurs to delay the work the foreman is promptly notified by the men. It becomes more a question of seeing that the men are supplied with materials, and an incompetent foreman is quickly found out. Plainly a more ordinary man will make a good foreman under the piece-work system, and a knowledge of the particular arrangement and system of any one shop is more essential than things of a general nature which could possibly be taught in such a school as Mr. Higgins advocates. It is believed under these circumstances that manufacturers will get better results from taking boys with a common school education and giving them such special training as their particular business may require.

Under the new conditions brought about through automatic machinery and piece-work the boy who has obtained a general knowledge of the machinists' trade at say a half-time school would not be very much different from the technical graduate, who finds there is no market of consequence for his services until he has mastered the details of at least one kind of work. If the country is full of disgruntled technically trained engineers who have failed to realize their expectations, as Mr. Higgins would seem to believe, there is reason to think that the same thing would result from an attempt to make general machinists and foremen on a large scale in schools, when the demand is really for specialists; the majority would be disappointed men with just enough education to make them dangerous to turn loose among ordinary workmen. The complaints of disappointed engineers, on the other hand, probably do very little harm.

W.

On with the Tunnel.

New York, Jan. 13, 1900.

To the Editor of the Railroad Gazette:

It has often been noted that the very peculiar shape and location of the Island of Manhattan renders its transit problems far more intricate than those of other modern cities. This has also, in the case of the Manhattan elevated, operated to insure a phenomenal profit from the operation of long lines through narrow districts free from serious competition.

Our problem is considerably changed since the creation of Greater New York, largely in the demand of the neighboring boroughs for improved facilities to reach the business center of the city. The physical conditions are not, of course, changed. We have a narrow strip of land teeming, in its lower portion, with the business of the metropolis and separated from its greatest borough neighbor by an arm of sea and from its northern borough associate by a great distance, over which travel must now pass through a limited number of crowded streets. We cannot cut streets to simplify the downtown conditions, and the streets of this section seem destined always to sustain an increasing flood of vehicular travel through which our surface railroads must find their way with tedious and exasperating delays and hindrances.

The new bridges across the East River promise to do much to establish new lines of travel. The inadequacy of the present bridge is not due so much to the insufficiency of the structure as to the dangerously crowded condition of the avenues leading to it and to the unfortunate condition which prohibits any amelioration. Under the slightest pressure, the cars block each other on the Brooklyn side for a mile from the Bridge; while, on the Manhattan side, comfort and convenience are impossible and every passenger's life is at stake in the conflict for a foothold on the cars in the "rush" hours at night, and it is impossible to let the Brooklyn elevated trains cross the bridge because it is impossible to handle them on this side. It is perfectly evident that more tracks or a full complement of cars on the present tracks would simply increase the already overcongested conditions at the terminals and block all traffic.

The new bridge (No. 3), now assured, will divert the Brooklyn travel at a point beyond the present area of congestion and separate sharply the travel to Manhattan. This bridge should have been commenced ten years ago; it should now provide what the old bridge was intended to furnish—a broad highway over the river with the possibility of getting on and off the bridge without imminent risk to life and limb. In time, Second Avenue in Brooklyn should be extended to the bridge by the widening of Bond or Nevins streets, and this would give the southwestern district of Brooklyn a more complete highway connection with Manhattan than will ever be practicable in any other way. Electricity will diminish the operating expenses of the elevated roads and to some extent the annoyance to the residents along the lines, but there will be no considerable gain in carrying capacity or in speed.

There is some prospect that the underground roads will be built. It is unfortunate that these could not have been laid out on broader lines; that the original plan for two separate tunnels, one on each side of the island, could not have been retained. There is, of course, great disappointment in store for us from the "rapid transit" now promised. We shall not get much greater speed; we shall not have a line of any valuable length within five years, and we shall pay far more than we now expect for the work proposed. It is not at all certain that this franchise will prove attractive to anyone, even when built at the public expense. There is, however, a possibility of public benefit in the project which may materialize in some way before the time is completed.

More than a dozen great terminal stations surround the heart of London or exist in its midst and from these suburban trains run. A prominent engineer and a close student has said: "The local and suburban traffic on the railways entering London is enormous, and that it has grown to its present proportions and is constantly increasing, is largely due to the exertions of the railway companies themselves. It must pay them handsomely, else they would not be so eager to secure it by expending large sums of money on huge and costly terminal stations, or by offering such superior train facilities to attract it. The same result ought to be obtained in the large cities of the United States, if the railroad companies would exert themselves and take up the question in a broad and liberal way."

We have just one large terminal station in the Borough of Manhattan, accommodating three lines, all doing an immense business and much of it local or suburban. If one of these railroads or all of them combined should undertake to construct and operate the new tunnel road, I have no doubt whatever that it would prove greatly to the advantage of the company undertaking the work or that the service, even for the urban passenger, would be more certain and satisfactory than under any form of independent construction and operation. The great railroads entering the city from the north would find the tunnel a valuable collector of passengers from the lower city and by extension an important aid to connection with other lines.

It has been suggested quite recently that tunnels rather than bridges are needed to cross the East River, and that they can be built much cheaper and quicker than bridges. It is not wise to speak too confidently on these points; we live too near the Hudson River tunnel site. Long tunnels are utterly impracticable for the use of teams or carriages. Certain bridges will always be required for this kind of service, and besides, if the boroughs over the river are to be thoroughly consolidated with the Borough of Manhattan, certain well defined thoroughfares must be carried over the river, and on bridges. The need for closer physical consolidation between these boroughs needs no argument. It may, however, be interesting to note the growth of population in the Borough of Brooklyn and in the district north of 40th Street in Manhattan, which we will call North Manhattan, and in the Borough of the Bronx.

Increase in Population of North Manhattan and of the Boroughs of Brooklyn and the Bronx.

District.	1850.	1860.	1870.	1880.	1890.	1898.
Population of North Manhattan	....	125,171	204,996	351,597	633,769	906,423
Increase	....	.....	78,765	146,661	282,172	272,654
Population of the Borough of Bronx	....	.....	.....	31,621	74,085	137,975
Increase	....	.....	.....	.....	42,464	62,990
Population of N. Manhattan and Bronx	....	.....	.....	383,218	707,854	1,043,498
Increase	....	.....	.....	.....	324,636	335,644
Population of the Borough of Brooklyn	96,838	290,000	410,000	599,495	838,547	1,200,000
Increase	....	193,162	120,000	189,495	239,052	361,453
Perc'tage of increase.	....	200	42	46	40	43

It will be seen, from the table, that the influence of the elevated railroads was very marked in the development of North Manhattan between 1880 and 1890. The influence of the construction of the bridge over the East River, in the same decade, in the development of Brooklyn, seems quite overshadowed by the increase during the succeeding period since 1890. Brooklyn seems to have grown rapidly in spite of the hindrances of this later period, and its growth seems quite constant at about 40 per cent. per decade since 1860. It will be remembered that the Borough of Brooklyn is more than twice as large in area as North Manhattan and the Bronx combined; that homes may be obtained there, cheaper and easier than on this side of the river, and it must be conceded that the probable growth of Brooklyn is destined to continue greater than that of the other districts named, almost irrespective of facilities for crossing the river. The northern portion of this island and the Borough of the Bronx will prosper and fill up with comfortable homes, but Brooklyn will always be geographically nearer to the heart of the metropolis, and it will always have the greater population.

The proposition to extend the Rapid Transit Tunnel to South Brooklyn is a good one, and would have occurred a long time ago except for the rivalries and petty jealousies of our pre-metropolitan existence. It must be remembered, however, that in order to get under the river, as now proposed, the descent

must begin near the post-office; that the portion of the tunnel between that point and the Battery will be less convenient for local business on this account; that once under the river, on the line proposed, this tunnel could not come very near the surface within a mile of the river on its southern side; that it would have to be above five miles long to be of much value for the purpose intended and would cost upward of $15,000,000 and consume some five years in its construction. These figures are based on the experience of the Boston Subway and of the Mersey Railway at Liverpool, as well as on the general engineering experience with such works.

Such an extension of the rapid transit tunnel might be of great value to the northern railroads, should they decide to build or operate the tunnel; they would then be able to extend the tunnel to Staten Island and their tracks to New Jersey and thus obtain a possible line through the city to points in New Jersey and to the west and south, and they could then obtain access to storage sites and terminal water frontage not now accessible.

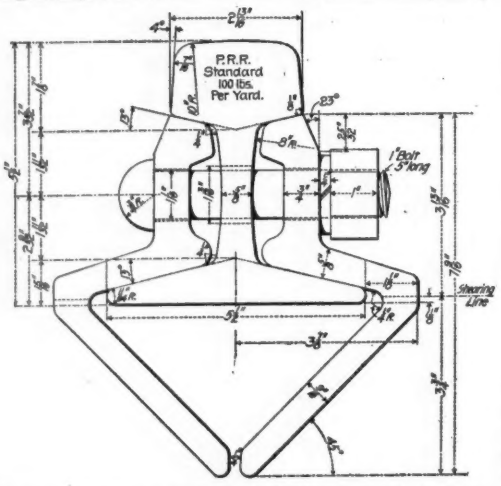
The Long Island Railroad project for a tunnel to Manhattan seems incomplete unless some extension of the line could be made. It would be difficult to handle trains at any head-house terminal obtainable underground in Manhattan. It would be better to build two tunnels, one at, say, 42d Street, and the other, as now projected, at Cortlandt Street, and connect these with an underground railroad, say, down Fifth Avenue and West Broadway. This would give them a long loop service and materially lessen all terminal difficulties; it would give them, as well, a splendid collecting ground with, say, four or five good stations, right in the heart of the city. It is probable that such a loop system might cost $15,000,000 to $20,000,000, but it would almost certainly earn a good dividend on its cost. No doubt some plan could be worked out by which this project could be brought within the zone of influence of the Rapid Transit Commission. The southerly of these two tunnels could be substituted for the Battery tunnel and the connecting railroad for a west side city line, so that the cost to the Long Island Railroad would include the north tunnel only.

Much of the above may seem idle speculation, but it seems desirable that the possibilities of the transit situation should be thoroughly discussed. From what has been stated it would seem as though there is a lively future possible for the rapid transit tunnel. It will, with this prospect, be very singular indeed if the city is not allowed to spend the money which it stands ready to spend to build it.

INTER-METROPOLITAN.

The M W 100 Per Cent. Rail Joint.

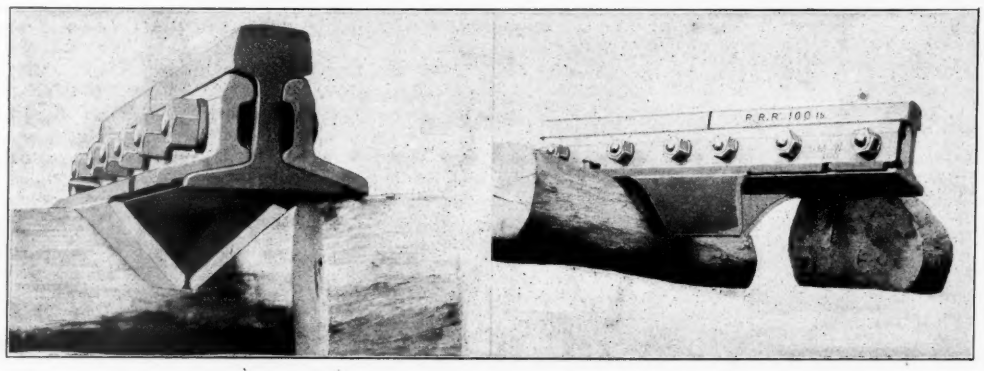
In our issue of Oct. 9, 1896, page 702, we showed engravings of a joint designed by Mr. M. W. Thomson, Principal Assistant Engineer of the Pennsylvania Railroad, and called the "100 per cent. joint." Of that joint 30 miles were put in track in 1896 and 30 miles in 1897. Early in 1897 it appeared that the structure was more rigid than it should be, especially as regards the lugs or flanges resting on the ties. It will be remembered that the flange of the angle plate was cut out in such a way that the portion between the ties could be bent down and in, as shown in the engravings herewith, while at the ends of the splices,



flanges, 7 in. wide, rested on the ties. Each of these flanges had two spike holes.

Mr. Thomson designed later the modified joint shown now and July 20 of that year patented it. Describing in his patent specifications the difference, he says: "The splice bar of my earlier patent may be said to be in the nature of a bridge resting upon the two cross ties as abutments, and stresses received where the ends of the rails come together may be carried back through the splice bars and delivered to the cross ties through the bases or lugs of the bars resting upon the ties; whereas in my present improvement the end portions of the inbent flange being cut away, each pair of splice bars acts exclusively as a splicing structure and stresses . . . are not carried back to the ties, except as they are carried through the rails themselves."

It is Mr. Thomson's opinion that it is more practical to treat the rail structure separately and supply a splicing structure which shall insure a uniform carrying capacity throughout than to provide further vertical and lateral fastenings to the ties, which shall also be uniform throughout. A remarkable fact seems to have been observed lately, namely, that with strong lateral bracing at the joints, such as would prevent any sidewise yielding, there is a tendency to throw the trains from side to side and cut the sides of the rail head unevenly. The importance of this very interesting fact will now be developed in comparative trials. During the year 1899 the Pennsylvania has had 970 pairs of the new joint, with the tie part of the flange cut away, in main line track, and so far the reports are most favorable. Certain particulars of this new splice, as compared with an older standard, are shown in the table which follows:



The M W 100 Splice—100-lb. Rail.

Section.	Length.	Weight.	Safe load.	I.	Area.	C.
100-lb. rail	.....	.....	48,700 lbs.	36.50	9.6997	2.66
No. 8 splice.	34 in.	74.8 lbs. pair	16,700 "	8.06	4.0222	1.71
M. W. 100 splice	31 "	85.40 "	46,600 "	53.00	6.9727	4.04
85-lb. rail.	.....	.....	41,200 "	27.86	8.2307	2.40
No. 6 splice.	34 in.	66.12 lbs. pair	12,300 "	5.48	3.5217	1.57
M. W. 85 splice	31 "	75.00 "	35,700 "	38.15	6.1294	3.80
70-lb. rail.	.....	.....	26,400 "	16.28	6.7483	2.19
No. 4 splice.	34 in.	54.8 lbs. pair	8,000 "	3.34	2.9338	1.47

In this table the safe load and moment of inertia of splices are taken for a pair. The area is for one splice. The safe load is calculated by formula $M = S\frac{I}{C}$, in which M = Bending moment; S = 16,000 lbs. fibre stress; I = Moment of intertia; C = Distance in inches from neutral axis to lowermost fibre; distance C to C supports = 18 in.; 3.492 cu. in. steel = 1 lb.

Exhaust and Draft in Locomotives.

As was announced some time ago, Mr. C. H Quereau, Assistant Superintendent of Machinery of the Denver & Rio Grande, was appointed to report on the above subject to the Sixth Session of the International Railway Congress to be held next summer. The question runs as follows: "Means adopted to increase the production of steam by increased draft; to avoid fires caused by sparks from the stack; to utilize the heat of the exhaust steam." It will be seen that this covers the whole subject of locomotive front end construction, a subject that has been repeatedly discussed, and yet there is scarcely another locomotive question in such a chaotic state. Mr. Quereau has plainly made his study with an unprejudiced mind, an unusual thing where locomotive front ends are concerned, the result being that his report is the clearest and best exposition of American practice that we have seen.

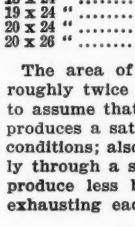
A circular letter was sent to the heads of motive power departments of 120 leading railroads in the United States, Canada and Mexico, and replies were received from 33 roads, which own over 15,000 of a total of 36,234 locomotives. These replies gave the particulars of front-end practice for a period of ten years, which information is compiled in the first part of the report with engravings illustrating present practice in the various details.

The following summary of American practice is given in full:

Fuel.—Coal, with evaporative results varying from 10.76 to 3.10 lbs. of water per pound of coal, is the almost universal fuel, though in the west, where the quality of the coal is poor and the cost high, fuel oil is used successfully.

Exhaust Pipe.—The single exhaust pipe is evidently the preference of most roads and apparently is displacing the double pipe. There has been a very decided shortening of the length of the pipe during the past ten years, notwithstanding that the average diameter of the smoke box must have increased in the same period. Because of the very general adoption of this change and the considerable amount the pipes have been shortened, it seems reasonable to assume that it must have been noticeably beneficial.

Exhaust Tip.—The tip shown in Fig. b is essentially that recommended by the Master Mechanics' committee. That 60 per cent. of the roads reporting use this form as standard is presumptive evidence that it is the most efficient form. The tips, Figs. c and d, vary but little from Fig. a in the shape of the exhaust and the absence of a shoulder, which must produce back pressure. If these are classed with b, the result is that 84 per cent. of the tips have no shoulder. A reasonable interpretation of these facts is that tips with shoulders are less efficient than those without. There is one advantage in the shouldered tip; namely, that it will not gum up by the accumulation of oil from the exhaust.

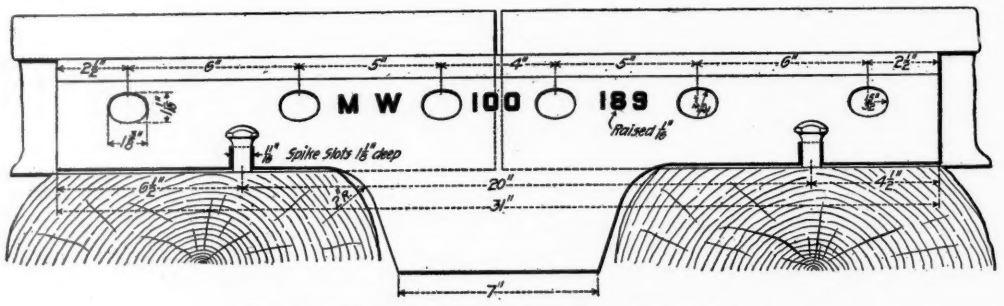


There are good reasons for the extensive use of the single exhaust tip, which presupposes the use of a single exhaust pipe. The following table gives the areas in square inches of different tips:

Average Exhaust Tips.

Cylinders.	Single. Diameter.	Single. Area.	Double. Diameter.	Double. Area.
17 x 24 in.	4¼ in.	14.2 sq. in.	3⅛ in.	7.7 sq. in.
18 x 24 "	4½ "	15.9 " "	3⅜ "	8.9 " "
19 x 24 "	4¾ "	17.7 " "	3⅜ "	8.9 " "
20 x 24 "	5 "	19.6 " "	3⅜ "	8.9 " "
20 x 26 "	5 "	19.6 " "	3½ "	9.6 " "

The area of the single exhaust tip is shown to be roughly twice that of the double tip. It is reasonable to assume that each is as large as it can be made and produces a satisfactory amount of steam under service conditions; also that two cylinders exhausting alternately through a single tip will meet less resistance, hence produce less back pressure, than the same cylinders exhausting each through a separate tip half the area of the single tip; hence that the single tip is more efficient than the double. This conclusion would be unwarranted unless it had been shown that with the single exhaust pipe and tip and a partition of the proper height between the exhausts, the exhausts from one cylinder do not interfere with those from the other. The use of a bridge or bar in the exhaust tip is universally condemned, except as a temporary expedient.



The M W 100 Splice for 100-lb. Rail—Pennsylvania Railroad.

Stack.—The cast-iron choke, or tapered stack, is the choice of 80 per cent. of the roads reporting, and growing in favor. There is also an increasing tendency to reduce the diameter of the stack, the cylinders remaining the same. The diamond stack is standard on but one railroad system, and it is a significant fact that two roads, which at one time were under the control of the system on which the diamond stack is standard and inherited it, have begun to discard the diamond stack for the tapered design. From these facts it seems reasonable to conclude that experience has shown the diamond stack to be less efficient than either the straight or taper form. With the diamond stack the exhaust steam cannot escape in a direct line because of the cone, and the netting area through which the gases must escape is less than with either of the others.

There appear to be no rules for varying the stack dimensions for different sizes of cylinders. It is evident that the rule given by the Master Mechanics' committee concerning the best relation between the stack and the exhaust tip has had considerable influence.

Diaphragm.—The chief function of the diaphragm, which is used only with straight or tapered stacks, is to regulate the distribution of the draft through the flues and grates. They are used incidentally to extinguish and break the sparks coming through the flues. The Michigan Central has increased their efficiency in this respect by lining the surfaces of the baffle plates against which the sparks strike with steel netting having 2½ x 2½ meshes per square inch and wire 0.109 in. in diameter. These functions apply both to the diaphragms wholly back of the exhaust pipe and to those extending in front of the exhaust pipe. The advantage claimed for the latter over the former is their action in sweeping practically all the cinders from the smoke box. The Chicago Great Western has found that the diaphragm when extending forward of the exhaust pipe causes excessive wear to both this and the steam pipes.

Draft Pipes.—The use of draft pipes with extension front ends has increased considerably during the past few years. There can be little reason for doubt, judging by the reports, that their use materially increases the draft, which must result in increasing the efficiency of the exhaust by allowing an increase in the diameter of the tip and the consequent reduction in back pressure. On the other hand, there is no doubt that this advantage is accompanied by occasional delays for lack of steam due to the petticoat pipes working out of adjustment or becoming warped by heat. Such delays are frequently due to poor designs and more frequently to carelessness on the part of round house men whose duty it is to adjust these parts, but a certain amount of such careless work can never be entirely obviated because of the class of men to which this work must almost necessarily be intrusted. Again, it is entirely probable that a considerable number of these delays are not known to the heads of the motive power departments, and it was to these that the circular letter was addressed.

Front Ends.—The original purpose for which the extended front end was designed was to serve as a receptacle for cinders. That it is not very efficient in accomplishing this end was shown by the results of a test with the mounted locomotive at Purdue University, given in a paper by Prof. W. F. M. Goss, entitled, "The Effect of High Rates of Combustion Upon the Efficiency of Locomotive Boilers," before the New York Railroad Club, September 17, 1896. The locomotive tested had 17.5 sq. ft. of grate area, and a front end 52 in. in diameter by 64 in. long, including the extension; cylinders 17 x 24 in.; exhaust tip double, each 3 in. in diameter. The average speed in miles per hour was 25 and the duration of the test six hours, making it equivalent to a run of 150 miles. As the locomotive was mounted on wheels controlled by friction brakes and did not move in relation to the earth, the opportunities for making accurate observations and measurements were all that could be desired. The results showed that 75 lbs. of sparks were retained in the front end at the end of the run, while 294 lbs. had passed through the stack.

The fact that sixteen out of twenty-five roads reporting have shortened their extensions an average of 17 in. in the past ten years shows quite conclusively that experience has demonstrated it does not accomplish the end for which it was designed, or that the gain in draft by shortening is more valuable than the original purpose.

The report next gives a review of tests with exhaust nozzles and stacks made by the Chicago, Burlington & Quincy, by Prof. Goss, at Purdue University, and by the Chicago & Northwestern, which information has already been published in the proceedings of the Western Railway Club and the Master Mechanics' Association. Then follows a general discussion of the subject by Mr. Quereau and his conclusions, which are as follows:

Too frequently general principles are entirely overlooked, or not given sufficient weight. The statement has frequently been made that draft appliances which have been proved by extended experience and experiments to be the best adapted for a given quality of coal or section of the country, do not, and will not, prove at all adapted for similar classes of coal in other sections, and that it is necessary to use entirely different designs. This seems an unreasonable proposition. In this connection it should not be forgotten that the discussion relates only to draft arrangements, and not to the other parts of steam-producing appliances, such as grate area and the distribution of heating surfaces.

The sole purpose of the draft appliances is to produce a vacuum by means of which the necessary oxygen for the combustion of the fuel is provided, and to properly distribute this. The primary source of the forced draft necessary with locomotives is the force of the exhaust steam, and the most efficient design of draft arrangements is that which will produce the required vacuum with the least loss of power, that is, with the least back pressure. Assuming that such a design has been devised and its efficiency established, it follows that it must be the most efficient whatever the locality in which it may be used, and whatever the grade of coal, and the only reasonable change in the design which should be allowed is to increase or decrease the vacuum to meet the necessities of the case by increasing or decreasing the back pressure.

No claim is made that this most efficient arrangement has been designed, but it seems reasonable to believe it is within the range of possibility, and when designed should be universally the most efficient. For instance, it having been shown that the shorter the front end, the more efficient the exhaust jet is, this remains true the world over, no matter what the fuel or other conditions may be; as the most efficient method of regulating the back pressure has been shown to be by means of the tip, any design which fails to make the area of the tip less than that of every section between it and the cylinder must be faulty, wherever used. It is granted that other considerations than the greatest efficiency, such as convenience and cheapness of manufacture, should frequently determine matters of design.

It is quite commonly believed and stated that the final adjustment of parts of the draft arrangements, such as draft pipes, should be made, not on the testing plant, but with the locomotive in service, and that the efficiency of stack designs can be proved only in the same way. In short that the results obtained on the testing plant serve only as indications as to the most efficient arrangement or design of certain parts. If the testing plant is such as is used at the Purdue University and by the Chicago & Northwestern, where the locomotive can be tested under service conditions, there is room for argument as to the correctness of the statement. It certainly would not be made as to the most efficient steam distribution. Why should the investigation of the production and distribution of the draft be based on a different principle?

The most efficient draft design is that which produces a given vacuum, and properly distributes it, with the least back pressure. Is it not reasonable to believe that the same methods and apparatus, by which it was demonstrated that the shorter the front end the more efficient the exhaust jet, could be successfully used to determine as certainly the best adjustment of the petticoat pipes, the best proportions and shape of the stack, and the proper arrangement of the baffle plates to secure any desired distribution of the draft? That this would demand considerable time and careful experimenting will be admitted without argument, but results so obtained would have the decided advantage of being free from personal prejudice and based on a more solid foundation than mere belief.

Quite frequently very efficient designs are condemned because those in charge fail to assume that the enginemen are inefficient or poorly trained, but conclude, almost as a matter of course, that it must be the draft apparatus. An instance may be of service in making the point clear. A design of draft appliances which distributed the draft uniformly was in successful operation on a certain division, which secured an increase in the diameter of the tip, thereby increasing the power and efficiency of the locomotives on which it was used, also their steam capacity, but at the same time made it necessary that the fire on the grates be comparatively light and evenly distributed, necessitating careful work on the part of both the fireman and engineman. It happened that these locomotives were sent to a division where the front end arrangements concentrated the draft mainly on the front half of the grate, thereby necessitating a heavy fire forward and less care on the part of the enginemen. As a natural consequence the engines which were proved to be the best on one division were promptly condemned on the other, on the ground that the draft arrangements were faulty, while the fact in the case was that the men were at fault. Because of the experience of the first division, the engines finally became favorites on the other, but had they come directly on to the second division from the manufacturers, it is more than probable the design of the draft arrangements would have been condemned beyond redemption, a period of changes based on cut and try methods would have followed, and finally, when the enginemen had become accustomed to the changed conditions, and the production of steam had thereby become satisfactory, whatever arrangements happened to be on the engines at the time would have received the full credit for the improvement.

CONCLUSIONS.

(a) Means Adopted to Increase the Production of Steam by Increased Draft.

This topic naturally falls under two heads. The producing of the vacuum, and the distribution of the draft:

The Production of the Vacuum.

1.—The most efficient means of producing the vacuum are evidently those which accomplish the result with the least back pressure in the cylinders.

2.—These can best be determined with a locomotive on a testing plant where the conditions can be made those of regular service.

3.—The proper basis for determining efficiency is that which compares the cause, back pressure, with the result, vacuum, and conclusions drawn solely from the vacuum obtained are of doubtful value.

4.—The steam passages from the cylinder should be of ample proportions.

5.—The exhaust pipe passages should gradually contract from the bottom to the tip, without abrupt curves.

6.—The area of the opening through the tip should be less than that of any section between it and the cylinder.

7.—The exhaust pipe should be single, with a partition but little, if any, higher than 13 in., and the total height as short as possible consistent with easy curves in the pipe and a proper arrangement of the netting, providing the height is not less than 19 in.

8.—The steam passage in the exhaust tip should be of the shape shown in Figure b.

9.—Crossbars in the tip lessen the efficiency of the exhaust jet.

10.—The front end should be as short as possible.

11.—With front ends more than 60 in. in diameter, double draft pipes increase the efficiency, but careful designing and thorough workmanship are necessary to prevent them from warping and working out of adjustment. If they become displaced they are worse than useless.

12.—With properly designed draft pipes it is probable that the greater the distance from the exhaust tip to the base, or choke, of the stack the greater the efficiency.

13.—Either the taper or straight stack is more efficient than the diamond stack.

14.—Probably the taper stack is somewhat more efficient than the straight, when the proportions of each are the best for any given case, because of the more easy approach and exit afforded the gases by the former.

15.—The correct rules for the most efficient stack proportions are still open to question.

16.—The theory of the adjustable exhaust tip is admirable, but the results of experience have been that those designs tried so far soon become inoperative. To be permanently successful a design should be automatic and beyond the control of the engineman, connected with the reversing gear, for instance.

17.—As far as practicable the plane of the netting should be at right angles to the currents of gases passing through it, so as to offer as little resistance as possible.

18.—The area of the openings through the netting should be greater than that through the flues, when possible.

The Distribution of the Draft.

So far as known there are no published results of the most efficient arrangement of diaphragm plates or draft pipes, so that conclusions concerning them are largely matters of opinion or personal experience.

19.—With diamond stacks the distribution of the draft is best accomplished by the use of draft, or petticoat, pipes.

20.—With extended front ends and straight or taper stacks the baffle plates are almost entirely depended on for regulating the distribution.

21.—It seems entirely probable that with the extended front end a design may be developed which will leave out the baffle plates and depend entirely on draft pipes for the distribution of the draft, and that such a design would be more efficient than those which depend on the baffle plates.

(b) For Preventing Fires Caused by Sparks from the Stack.

22.—The extended front end is of little practical use as a receptacle for cinders.

23.—The baffle plates and netting should be so designed as to extinguish the sparks, break the cinders up, and then discharge them into the open air.

24.—Systematic and competent inspection of front end arrangements, especially the netting, at regular intervals, in connection with a permanent record showing the condition at the time of inspection and the repairs made.

25.—The use of fire guards made by plowing two or three furrows as far from the track as possible and then burning over the ground between the tracks and furrows.

(c) For Utilizing the Heat of the Exhaust Steam.

26.—American practice has not yet developed a successful design for this purpose, though two roads are making the attempt.

27.—The exhaust from the air pump is being successfully used by a number of roads to heat the water in the tender.

28.—Because of the fact that most American locomotives are equipped with injectors, instead of pumps, for feeding the boiler with water, and that the injectors will not work with feed water hotter than about 120° Fahr., it seems probable that the maximum benefits of heating the feed water by means of the air pump exhaust will not be derived till the control of the temperature of the feed water is made automatic. Experiments with this end in view are being made.

An appendix contains a discussion of the Von Borries-Troske tests made at Hanover, Germany, in which it is pointed out that their conclusions were based solely on the vacuum produced, on the assumption that the exhaust pipe pressure, or back pressure, and the boiler pressure were constant; or that the variations were comparatively of little importance. This assumption is shown to be incorrect and evidently led to at least two incorrect conclusions. First, that exhaust nozzles of the same opening, but of different inclinations and shapes, have the same effect on the exhaust. Second, that the action of a locomotive's draft can be increased by the use of a bridge in the nozzle flush with the top. Also, the conclusions from the Hanover tests to determine the form and divergence of the exhaust jet are questioned, because these tests were made without a stack and the portion of the apparatus corresponding to the smoke arch was very much smaller than any smoke arch in service, being only 2 ft. 3½ in. in diameter and 1 ft. 11¼ in. high. The conclusion was drawn from these tests that with a proper nozzle distance the exhaust jet would fill the stack at its smallest diameter. The conclusion from the Master Mechanics' Association tests with actual locomotives on a testing plant was, "the exhaust jet under ordinary circumstances does not fill the stack until near the top," while tests made on the Chicago, Burlington & Quincy showed that the exhaust jet did not touch the stack at any point at very high passenger speeds. Other features of the Hanover experiments are criticised and Mr. Quereau concludes that:

First, where the conclusions of the Master Mechanics' Association tests and those drawn from the Hanover tests disagree, the Master Mechanics' conclusions should prevail. Second, there are good reasons for questioning the correctness of the conclusions of the Hanover tests as to the best proportions and shape for the stack, though probably these conclusions have greater weight than any others.

New York Rapid Transit.

On Monday of this week the bids for building and working the underground rapid transit railroad in New York City were opened by the Commissioners. Two bids were made, one by Mr. Andrew Onderdonk and one by Mr. John P. McDonald. Mr. Onderdonk's bid for the complete work is $39,300,000. He also offers to pay, as required by law, the interest on the bonds issued by the city and 1 per cent. of the gross receipts to be applied to the sinking fund. He also agrees to pay for the 50 years' rental 5 per cent. on

the first million of gross receipts over $5,000,000, and 2½ per cent. additional on each additional million up to a maximum of 15 per cent.

Mr. McDonald offers to complete the work for $35,000,000, but does not offer to pay any percentage of the gross receipts other than the interest on the bonds issued by the city and the additional 1 per cent. to be applied to the sinking fund, as required by the terms of the contract.

On Tuesday the Commission awarded the contract to Mr. McDonald, provided that he shall, within 10 days of this award, duly execute the contract, make the required deposit of $1,000,000, and give the required bonds for construction and equipment and the continuing bond. The President of the Board is authorized at his discretion to extend this period for not more than 10 days. Furthermore, immediately after the contract is made the President shall "exercise the option reserved to the city by the contract for the construction and operation of Sections II., III. and IV." This, as we understand it, means that the contractor will be expected to proceed at once with the whole work.

American Practice in Block Signaling.*

By B. B. Adams.

[*Continued from Page 5.*]

II.

The following paragraphs in small type are the block signal regulations issued by the Pennsylvania Railroad to signalmen, enginemen, conductors and all concerned. The references are to explantory notes following the rules:

BLOCK SIGNALS.

201. The section of track between two block stations i termed a "block."

Trains running by block signal rules are to be governed absolutely by the fixed signals at block stations [1] and will not observe Rules Nos. 87, 88 and 89.

202. The block signals are absolute or permissive. For the absolute block they will display red or white; for the permissive block, red, green or white.

Red indicates that the block is not clear, and means stop. White indicates that the block is clear, and is permission to proceed. Green indicates that there are one or more trains on the block, and is permission to proceed, with this knowledge.

Where a semaphore arm is used, a horizontal position means the same as red; nearly vertical, the same as white; and inclined, midway between these positions, the same as green.

203. Night signals must be displayed from one hour before sunset until one hour after sunrise and when, from fog or other cause, day signals cannot be clearly seen.

204. The signal must always display red, excepting when changed to white or green to permit a train to pass. As soon as the whole of a train has passed the signal, and not before, it must be returned to red. When displaying white or green, the signal must be held by the hand and not fastened[2].

205. No train must pass a block station while red is displayed, excepting under the circumstances herein provided for.

A train approaching a block station must so run that it can be stopped before the engine passes the signal, if the signal to proceed is not displayed[3].

A train must not be backed after stopping at a block station[4]. If from any cause the engine shall have passed the signal without the signal to proceed having been displayed, the conductor will personally direct the engineman to proceed, after the proper signal is displayed.

In the absence of any signal at a block station trains must stop and ascertain the cause.

If a train arrives at a block station where the operator is absent or disabled, or where the signal is not working, and orders cannot be obtained, the train shall proceed as if green were displayed[5]. If there is an operator on duty and he cannot get orders for the train, he must give it written notice of the reason for the proper signal not being displayed.

If the telegraph line fails after a train enters a block, and the block cannot be ascertained to be clear for an approaching train, such train shall be stopped by red and notified by the operator in writing. Green shall then be displayed for the train to proceed. Where the absolute block is used, it shall proceed, after getting such notice, as if green were displayed[6].

206. When a train approaches a block station, white will be displayed, if there is no train upon the block ahead.

207. Where the absolute block is used, red must continue to be displayed after a train has entered a block, until it has cleared it.

208. Where the permissive block is used, red must continue to be displayed after a passenger train has entered a block until it has cleared it. After any other than a passenger train has entered a block, and has not cleared it, green must be displayed for any following train approaching. If the following train is a passenger train, it must first be stopped by red and notified that there is a train ahead, unless the latter has had time to reach a crossing or siding on the block[7].

209. When a train is required to cross over to the opposite track between block stations, the conductor, before crossing over, must so notify the operator at the block station to be last passed. This operator must notify the operator at the next block station in the direction in which the train is moving, who must display green for any train approaching on the opposite track, until informed that the train that was to cross over has reached one of the block stations. The train must not enter the block until the conductor is informed that the operator at the next block station has been so notified, and Rules Nos. 100, 101 and 102 must be observed[8].

210. At starting and junction points trains must not enter on the main track until the signal to proceed is given. This signal must not be given until the train has been protected on any track it is to enter upon or cross. Such protection must be by notice to the block stations in the proper directions and by the use of signals as required by the rules, or by fixed distant signals.

211. Operators must promptly report to the next block stations in each direction the movement of trains passing their stations. A train must not be reported as having passed until the rear end has passed at least 100 yards beyond the block signal [9].

212. When a passenger train is stopped by the block signal at a station where it receives or discharges passengers, it may run to the platform, and, if the block signal cannot be seen by the engineman, the conductor will, after the proper signal is displayed, personally direct him to proceed[10].

213. If a train passing a block station has no markers displayed, the operator must notify the operator at the next block station ahead, who must signal the train as per Rule No. 62, and the train must be governed accordingly. Notice must also be given to the block station in the rear, and the intermediate block in that direction must not be considered clear until information is received from the conductor that he has all his train[11].

214. An operator having orders for a train must display a red, or train order, signal, in addition to the block signal.

215. Operators will be governed by the following telegraph signals:

"5" Is the track clear?

"No. 1" Track is not clear—hold the train.

"O K 35" Track is clear—let train come on[12].

216. The rules relating to Block Signals do not relieve trainmen from observing all rules in regard to the protection of their trains[13].

Notes on the Rules.—(1). Will not observe the time-interval rules. (2). A signal must not be fastened in a position to permit trains to pass, lest the signalman turn his attention to other duties and forget what or how many trains he has permitted to enter the block.

(3). To guard against violations of this rule where there is no distant signal, the 300-ft. leeway, provided for in Rule 211, is prescribed. In some cases this leeway is made 900 ft.

(4). The movement of a train is from one point to another. A train, after passing any given point has surrendered the track at that point to following trains and has no right to it whatever. This principle is fundamental in train movement, though not often mentioned in rules. It is especially important where permissive block-signaling is practiced, as the engineman of train B, closely following train A, may be depending upon the movement of the tail end of train A, on which he constantly keeps his eye, to guide him in the regulation of the speed of his own train.

(5). It is to be borne in mind that these regulations are for a double track railroad. On a single track, with trains liable to come from the other direction, the failure of the telegraph wire or the disablement of the operator would compel a train in such a situation to wait indefinitely, or to proceed only after sending a man ahead with stop signals, the train then following far enough behind him to give room for any opposing train to be stopped. Only in this way can the block system afford full protection from collision on single track.

(6). This refers to block sections where, ordinarily, no permissive blocking is authoriezd.

(7). Ordinarily passenger trains are never stopped as prescribed in Rule 208. The time at which a passenger train is due, say, at station B, is known to the conductor of any preceding inferior train, and he calculates to clear station C before the passenger is due at B. If he cannot do this he does not enter block B C, but puts his train on a side track and waits for the passenger train to go ahead of him. If the passenger train is known to be behind time the train despatcher, who keeps a constant record of all trains and their whereabouts, notifies the conductor of the inferior train so that he can go on ahead of the passenger.

(8). The conductor of a train on track No. 2, moving from B toward C, desiring to cross over to track No. 1, notifies the signal man at B; B informs C and C cautions trains on track No. 1 moving toward B, according to the rule. Rules 100, 101 and 102 require a train crossing over to send out a flagman on track 1 in the direction of C; and prescribe the method of procedure if a freight gets caught at the crossover when superior trains are due from both directions.

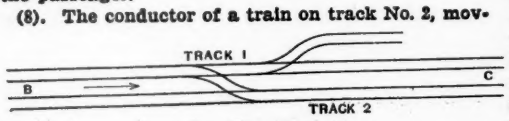


Fig. 11.

Crossover tracks which are near a signal cabin—say within 500 to 1,000 ft.—can be watched by the signalman. At the principal stations on the Pennsylvania the switches of such crossovers, as well as those leading to side tracks, are worked from the signal cabin and their levers are interlocked with those of the signals, so that it is mechanically impossible for the attendant to give a clear signal to a train unless the switches are in the right position. Switches leading to tracks remote from a cabin may be controlled from the cabin either by an electric lock or by making the signalman the sole custodian of the key to the switch; but neither of these methods has been used to any extent in America.

(9). See Note 3, above.

(10). See discussion of diagram, Fig. 6.

(11). Markers are the flags or lights at the rear end of a train. Their absence indicates that the train has broken apart and that a portion of its cars have been left behind. The signal prescribed in Rule 62 informs the trainmen that they have lost a part of their train.

(12). These signals are purely arbitrary. The second one means "No; wait," the numeral "1" being the customary telegraphic signal for "wait."

(13). No. 216 refers to the long standing rules for the protection of trains from collision when running under the time-interval system. These rules, until recently, were very precise and elaborate, and in many situations would require a flagman to go back half a mile, and very likely delay his own or a following train, when his going back was unnecessary. With fast trains running not more than three minutes apart, as is possible with the block system, but is not allowed with the time interval system (under which the flagging rules have been developed), a flagman may at times find it impossible to carry out his regulations. Moreover, with the knowledge that the block system prevents collisions, which flagmen and all concerned learn by observation, all hands come to look upon flagging as unnecessary; and, as a consequence, the enforcement of the rules becomes difficult. The Pennsylvania flagging rule is now that of the standard code of the American Railway Association, which is very brief, leaving large discretion to the conductor, who, of course, is responsible for the efficient performance of duty by the flagman. The rule reads:

99. When a train stops or is delayed, under circumstances in which it may be overtaken by another train, the flagman must go back immediately with stop signals a sufficient distance to insure full protection. When recalled he may return to his train, first placing two torpedoes on the rail when the conditions require it.

Cost of Installation and Maintenance.—From what has been said concerning the different arrangements of signals it will be seen that the cost of the apparatus necessary for block signaling will vary according to the extent of the conveniences provided. The simplest semaphore, with connections to the office, can be estimated at $50 to $75. The addition of starting or distant signals would increase the cost nearly in proportion to the increase in the number of signals. Where an additional telegraph wire has to be put up in consequence of the introduction of the block system the cost of wire (iron) in place will be about $25 to $35 a mile, the poles being already in place. Copper wire costs four or five times as much per pound as iron, but a smaller size can be used, so that the additional cost of a line would be perhaps $20 a mile. The telegraph instruments for an office (one line) will cost about $10. There must be a main battery every five or ten miles, as on a busy road not more than from four to eight offices can use the same wire. A two-story signalman's cabin costs about $500. A cabin not too large to be carried on a platform car—say not over 10 ft. square—can be built in the shops at much smaller cost. But this, of course, can be done only where the road between the shop and the proposed location is sufficiently free from side and overhead obstructions to permit the transportation of the cabin.

With the telegraph block system the principal item of maintenance is the wages of operators and inspectors, to which is to be added the maintenance of buildings, with fuel and lights, where a building is erected especially for this service. At stations where operators have no switches to attend to, and no other work of any kind, they work 12 hours each, daily, seven days in the week. The pay for these men is from $45 to $55 monthly. Where the duties are more complex the pay is higher, and where a considerable number of interlocking switches is operated, the working time for each man is eight hours daily. The men at these important cabins are paid, on the Pennsylvania, from $50 to $70 per month. The duties of the inspectors are light, as far as simple block stations are concerned. Their work is chiefly in connection with the interlocking apparatus of switches and the signals which control them, and the time spent inspecting simple block stations is treated as a secondary matter.

[TO BE CONTINUED.]

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American Society of Civil Engineers.

The annual meeting of the American Society of Civil Engineers assembled in New York at 10 o'clock on Wednesday of this week. The morning hour was given up to the usual business and as a matter of the first interest. Although not first in the order of business, we give the list of officers elected as below:

President—John Findley Wallace, Chicago, Ill.

Vice-Presidents—Rudolph Hering, New York City, and Alfred Noble, Chicago, Ill.

Treasurer—Joseph M. Knap, New York City.

Directors—John F. O'Rourke, New York City; Henry B. Seaman, New York City; Thomas H. Johnson, Pittsburgh, Pa.; Joseph Ramsey, Jr., St. Louis, Mo.; Henry B. Richardson, New Orleans, La.; George A. Quinlan, Houston, Tex.

The report of the Board of Direction showed a net increase of membership during the year of 103 and the total membership on Dec. 31 as 2,228. Of these the Members numbered 1,370, the Associate Members 424 and the Juniors 263.

The losses by death during the year were 24 and these included three honorary members, quite an extraordinary loss in that very limited class. These were Gen. Greene and Gen. Wright and Colonel Adams.

The total attendance registered in the reading room during the year was 1,761. It is reported that the work of reclassifying and indexing the library is almost finished. The library has been divided into general classes and each of these is subdivided as necessary, the governing idea being to so arrange the books and to so group the cards as to enable one unaccustomed to the technicalities of library work to investigate a subject with the least possible loss of time and by a personal use of the index.

Among the general classes railroads have, by all odds, the greatest number of titles, namely, 3,042. The total number of titles classified to date is 11,623, representing 18,055 volumes, pamphlets, maps, etc. The total number of cards written to date is 42,057. The Board has under consideration the advisability of publishing a catalogue of the library for distribution to the membership.

In March the Board decided to publish in the Proceedings, as well as in the Transactions, all discussions on papers presented, in order to secure cross-discussion and to bring topics promptly before all members. The interest which this system has provoked is shown in the character and number of communications published since that time, and it is evident that the numbers of the Proceedings have a value which was lacking before. The publications of the Society for the year aggregate 2,941 pages. The net cost of publication, less advertisements and sales, amounts to $9,800.

The Norman medal for the year ending with the month of July, 1898, was awarded to Mr. B. F. Thomas, Member, for his paper on "Movable Dams"; and that for 1899 to Mr. E. H. Stone for his paper on "Safe Working Stresses for Railroad Bridges." The Rowland prize for the year ending July, 1898, was awarded to Henry Goldmark, Member, for his paper on "The Power Plant, Pipe Line, Etc., at Ogden, Utah," and that for 1899 to Mr. R. S. Buck for his paper on the "Railroad Arch Bridge at Niagara." The Collingwood prize for Juniors was not awarded.

The Board has decided to pay $10,000 on the house debt, reducing that debt to $75,000; and the Board has further adopted a resolution recommending that in future an annual payment be made upon this debt to amount to a sum not less than the entrance fees for the year. It is estimated that the amount of entrance fees yearly will be not less than $3,500, probably a little more. This would extinguish the debt in 20 years. The balance on hand Dec. 31 amounted to $13,728.

The programme of the meeting has already been printed, and further report must be postponed till next week.

Meeting of Railway Signaling Club.

The Railway Signaling Club held its January meeting at the Great Northern Hotel, Chicago, on Tuesday of last week. In the absence of President Keppel the chair was occupied by Mr. Frank Rhea. About 25 members were present and five new members were elected. The by-laws were altered so as to provide for dropping the names of members who do not pay their dues. The principal discussion of the meeting was on the paper by Mr. Rudd on "Slip Switches and Facing Points," which was published in the Railroad Gazette last week.

Mr. Miles (M. C.) thought Mr. Rudd's estimate of the cost of an electric lock very low. As electrical apparatus is somewhat costly and requires great care, Mr. Miles some years ago designed a spring centering device for switches. When the switch is in position the spring is compressed; if the connection should be broken the spring would force the switch toward the middle of its stroke and thus make it impossible for the signalman to lock it. This is very cheap and if properly maintained is satisfactory. Mr. Miles, however, uses the bolt lock wherever possible.

Mr. Elliott (C. M. & St. P.): With the necessary connections, Mr. Rudd's ararngement would cost probably $70. Therefore, the bolt lock is the most desirable arrangement. We use it wherever practicable and are using pipe connections for all home signals. Where one signal covers five or six switches it may be impossible to use the bolt lock. In that case I would bolt lock all which affected high speed trains. To put the bolt lock on a concrete foundation is, I think, bad practice. The bolt lock must be kept with the switch and should be put on the tie.

In discussing Mr. Rudd's diagrams Mr. Rhea (P. C. C. & St. L.) said that on his road five levers are used, one for the frog and one for each end of the slip.

Mr. Elliott, replying to a question, said that with the bolt locks in wire connections it was necessary to have adjusting screws close to the bolt lock. With this arrangement a three-inch slot is needed in the signal bar of the bolt lock. With a pipe connection a 2½-inch slot can be used. The Chicago, Milwaukee & St. Paul uses bolt locks with distant signal connections. With pipe connections the adjusting screw is placed between the bolt lock and the crank at the base of the signal; and there is a turnbuckle between the bolt lock and the lever. A compensator is used in pipe lines where the switch is beyond the signal.

Mr. Pflasterer uses pipe connections for all home signals and uses the bolt lock even if the switch is on one side of the tower and the signal on the other. The rod is run direct to the switch and from there back to the signal.

Mr. Rhea, replying to questions, said that the Turner facing point lock gave good results on his road. In this device the plunger moves in one direction when the switch is in one position and in the other direction when the switch is reversed. The Boylett device would accomplish equally good results if changed in a few minor details. It is expensive, however.

Mr. Miles, in using this device, found the rectangular plunger unsatisfactory and put a round one in its place.

After some further desultory talk on this subject the meeting took up the question of compensators for pipe lines on drawbridges. Mr. Elliott had found in some cases that money was wasted in this direction, as the bridge, being of metal, expanded concurrently with the signal connections. Mr. Elliott has one machine in a drawbridge tower working derails 2,027 ft. from the tower, the draw span being 360 ft. long. Contraction and expansion were troublesome, and it was necessary to design a special lock at the end of the draw span to provide for the three inches of contraction.

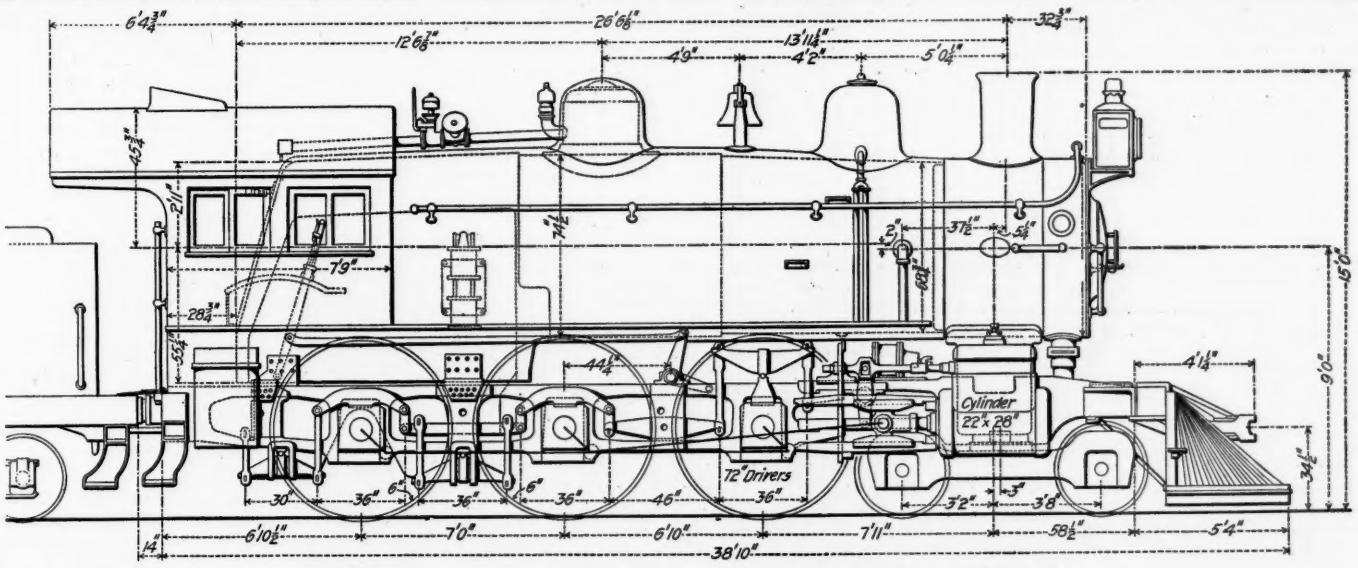
Mr. Hobson (A., T. & S. F.) has a 400-ft. draw span at the Mississippi River with a curved approach. He is going to put the couplers on sliding plates and have turnbuckles for easy adjustment. Mr. Hobson considered the question of using a sand track for a derailer at this bridge, but gave it up because it was feared that the maintenance of the sand at the proper depth would be troublesome to manage.

Discussing an inquiry made by Mr. Cowper (C., C. C. & St. L.), several members spoke in favor of the use of two-armed dwarf signals in yards in exceptional cases, as, for instance, where one of the tracks is used frequently by passenger trains; but the general opinion was that as a rule only one arm is needed for any number of diverging tracks where the speed is low. A multiplicity of arms, as was common in the practice of a dozen years ago, is all right in theory, but in practice the enginemen and trainmen will not learn the indications, and therefore the added complication is a wasteful expenditure. Mr. Hobson has a two-armed dwarf at the entrance to a yard, where heavy freight trains must know where they are going before they start.

The New 10-Wheelers for the Pennsylvania Lines.

The engraving shows the general elevation of one of a new group of locomotives now building at Altoona and at the Baldwin Works for the Pennsylvania Lines West of Pittsburgh known as the Class G 4 engines. These are intended for heavy passenger service and for fast freight. The passenger engines will have 72 in. drivers and the freight engines 62 in. drivers. In other respects the engines are identical. It will be observed that they have very capacious boilers and that the cylinders are 22 x 28 in. The grate area is 30.8 sq. ft.; the tube heating surface 2,652.2 sq. ft., and the firebox heating surface 162.43 sq. ft. These engines are to carry a working steam pressure of 225 lbs. The tenders will have a capacity for 6,500 gals. of water and about 22,000 lbs. of coal.

The aim has been not to make a particularly fast engine, but one which can take the very heavy trains running in passenger service on the Lines West of Pittsburgh along at a well sustained and fairly fast speed. One underlying idea has been to have an engine powerful enough to take these trains up the grades at a fair speed and so avoid the necessity for running very fast down grade. The Baldwin Works are building 15 of these engines.



New Ten-Wheel Passenger Locomotive for the Pennsylvania Lines West of Pittsburgh.

Experience in the Motive Power Department.

A lecture was recently given by Mr. R. H. Soule before the mechanical engineering students at Purdue University, entitled "Notes and Suggestions from Experience in the Motive Power Department of Railroads." Mr. Soule's wide and varied experience has afforded unusual opportunities for observing practice in several countries and collecting valuable information. By nature he is observing and systematic in preserving notes of things he sees so that the subject is really a most suitable one. Later, we believe, this and other lectures are to be published in full by the University, what follows being a series of extracts covering some of the most essential topics.

I have a great deal of respect for the profession of railroad mechanical engineering. The problems are very varied and very complex, and the situation on a large railroad, or even in a single large shop of a railroad, is constantly changing. There is such a large variety of labor and material involved that there are new combinations every day. In a large railroad shop you come to the shop in the morning and you are certainly sure to find a new combination different from that which existed twenty-four hours previously. I think it is also true that in the motive power department of a railroad there are more varieties of labor and material in use, under one control, than will be found in almost any other business. It can readily be imagined that this is true in regard to the variety of labor, for you have already gone far enough to know that a railroad shop must be organized to meet every one of a great variety of problems, but the great variety of material is not so apparent. The last railroad that I was connected with was the Norfolk & Western. I was there six years,

and, through the courtesy of the Superintendent of Motive Power and Chief Engineer I have obtained some statistics bearing on the variety of material that has to be used in the operation of that road. I shall deal only with approximate figures, and the facts are these: That in the maintenance of way department they use about five hundred different kinds of material, but in the motive power department they use about five thousand. In analyzing the operating expenses of a railroad, it is found that what is known as the "Conducting Transportation Account" shows the largest consumption of material, but the reason is that that large amount of material is almost entirely made up of coal for locomotives. The fact remains, however, that it is the motive power department which uses the greatest variety of materials.

The organization of the motive power department used by the larger roads was next described, from which we make but one extract:

An assistant engineer on a large railroad is necessary because the Superintendent of Motive Power gets so overrun with work that he has to unload on some one, and, therefore, it is convenient at least, to have one foot-loose man whom you can detail for special matters in order to relieve the congestion. And another particular in which the Assistant Engineer is valuable is because it is absolutely necessary to be able to produce close estimates of all sorts of improvements and even of current work, and it is very rare, unusual indeed, to find in the average railroad man any ability to make close estimates; and so this condition of things and this necessity has brought to the front these Assistant Engineers, who, by being furnished with special facilities, are accordingly trained to produce very close estimates at short notice; and I cannot overstate the importance of that work, and I think that is equally true in any business—the importance of making close estimates.

In a similar way shop organization and location and design were discussed:

The location of the shops on a railroad is something which has to be determined very carefully and in which nevertheless a great many mistakes have been made; but, in general, owing to the fact that the master mechanic is a connecting link between the mechanical department and the transportation department, it is important to have the shops and the master mechanic located at what might be called the operating centers of the railroad. I think it is also conceded that it is good practice, under most conditions, to concentrate the control of the engine work and the car work under the same head. The old way was to have a Master Car Builder and give him charge of the car work all over the road, and then there was a Master Mechanic to have charge of all the engine work. But there is no doubt about it that the tendency in recent times, and the best accepted practice, is to put all the shop work at each principal shop point under the control of the Master Mechanic. On a large railroad, one main shop for construction work will usually be sufficient, with other shops arranged for repair work and maintenance work only. In general, it can be said that the main shops should be so located that it will not be necessary to haul engines more than 350 miles for heavy repairs. The same is true of passenger cars, but in freight cars it is desirable to have facilities at closer intervals, say 250 miles.

The matter of designing shops for railroads is a very important one and I think it is true that no railroad shop was ever built which was found to be just right, and the reason is that we have to make so many assumptions. You must know in what proportion the work is to be divided between construction and repair work, and between locomotive and car work; the wisest railroad men often fail to make reliable predictions, so that the man who designs a shop has to base his designs upon a series of assumptions which are very likely to be wrong in some respect. The design of modern shops also introduces many nice questions in the use of compressed air and hydraulic plants and electricity. As an example, the Chicago, Burlington & Quincy people built new shops at Burlington, Iowa, in 1883. I was one of a party to visit those shops just after they were opened, and I went there a second time about one month ago. There was an engine in the shop then; it was new and yet the cab of the engine was lifted off and standing on the floor, and I asked why they had the cab off. They said: "With these big modern engines we have to lift the cabs off, as the head room between the floor and the overhead traveling cranes is so limited that we cannot lift one of these big modern engines off of its wheels without first removing the cab;" and yet this particular shop was designed by a man who stood very high in his profession at that time, and was quite the peer of his fellows in every respect. This only illustrates the extreme difficulty of making correct assumptions when designing a railroad shop.

One of the problems, that is closely allied, is the provision of suitable stations along the road for coaling engines, and improved practice has brought great changes. I know of one road where the average cost of handling coal is from twelve cents to fourteen cents a ton, but by introducing improvements it expects to bring that cost down to four cents. . . .

Treating locomotives as either passenger, freight or switching, it may be said in general, that in a switching engine, no matter what the type, because we have four-wheel, six-wheel and eight-wheel switching engines, the whole weight is on the drivers; and switching engines are equipped with only moderate sized boilers, the reason being that a switching engine is always working hard with a late cut-off, and with little possibility of using its steam expansively, as a road engine may do, after the desired speed has once been attained. The fire of the switching engine is therefore always stimulated by a very sharp exhaust blast, and a relatively small boiler will without difficulty develop the required amount of steam. In a freight engine, the conditions being that it shall haul as heavy a load as possible, at the desired speed, it then becomes necessary to throw all the weight possible on the drivers; but the desire for safe practice has compelled the use of a guiding truck for freight engines, although foreign practice, which we may make up our mind to follow later, does without guiding wheels. Throughout England and her colonies, and in other foreign countries as well, freight engines are to be found running on the road with no guiding truck whatever, and if it is safe practice in those countries, why is it not here in our own? The answer may be that up to the present time our tracks have not been so good as in England and on the Continent, but if our tracks are not now as good they soon will be. I feel safe in predicting that it will be a feature of future practice in this country to use freight engines without any guiding truck, and of correspondingly increased tractive power.

In the case of a passenger engine, the conditions are usually such that the engine must exert only a moderate amount of tractive power but must make a very high speed. The tractive power being a function of the weight on the drivers, you proceed to figure out the necessary weight on the drivers, and we will assume that it is thus found to be necessary to have two pairs of driving wheels; you must then figure out the proportions of the boiler in order that it shall furnish steam enough to supply the cylinders at the desired speed; that brings you to the exact type of the passenger engine which is generally two or three pairs of driving wheels with truck wheels in front, and now and then with additional truck wheels behind.

The horse-power of modern locomotives ranges from 750 to 1,750, and it may perhaps be something of a surprise to you to hear it stated that fast passenger engines in heavy service develop more horsepower than heavy freight engines do. . . .

There are no end of details in the different elements which go to make up a locomotive and which we cannot even touch upon now. The most important single feature is, however, undoubtedly the firebox. It has become pretty well understood that we have been forcing our locomotives too much, and Prof. Goss has helped railroad men very much by some experiments on the locomotive testing plant. The experiments showed that when the engine was burning about 50 lbs. of coal per square foot of grate area per hour, 8 lbs. of water were evaporated per pound of coal burned, but when the engine was forced until it was burning 180 lbs. of coal per square foot of grate area per hour, the evaporation of water per pound of coal burned fell off from 8 lbs. to 5 lbs.; this has had the effect of turning the attention of locomotive designers to the necessity for providing fireboxes with a large grate area, and that has led to the more extended use of what is known as the wide firebox, originally known as the Wootten firebox. The original Wootten firebox was open to a great many objections, but the modern wide firebox has been redesigned so that the flat surfaces have been completely eliminated and all the elements of the cross-sections are now segments of circles although it is not possible to make them of one radius. Also, Mr. Cornelius Vanderbilt, of the New York Central, has designed a new form of locomotive firebox involving the use of the corrugated tube without staybolts. One such engine was built and put into service and gave good results, although it showed a number of minor defects, but the New York Central evidently has faith in the idea, for it has recently placed a contract for some new engines, five of which are to be fitted with tubular corrugated fireboxes.

[TO BE CONTINUED.]

Annual Report of the Interstate Commerce Commission.

The Interstate Commerce Commission has sent out an abstract of its 13th annual report. The opening chapter recounts the efforts of the Commission to secure amendments to the Interstate Commerce law. The law has proved inadequate; further legislation is needed and is asked for by agricultural, manufacturing and commercial interests throughout the country, yet Congress has done nothing. Each year the need is more imperative and the arguments heretofore presented by the Commission are as strong as ever. "Nine-tenths of the people know that any railroad company can charge for its service whatever it pleases and as much as it pleases, without any real power in this Commission, or any other tribunal or court, to limit the amount of such charge for the future when complaint is made by an aggrieved shipper, and they are substantially of one mind in desiring that this and other defects in the statute be promptly remedied. It is also true that shippers generally have been practically unanimous in favor of a single classification of freights, one that will be uniform for all roads and all sections of the country, and reasonably stable when established." The Cullom bill * now pending in Congress embraces the more important amendments recommended by the Commission, and this was approved by a conference of commercial men at Chicago last November. If Congress continues to neglect the interests of the commercial public there may be an irresistible demand for the most radical and drastic legislation.

The unification of financial interests of the large railroads is the most notable feature of the railroad situation to-day. There is foreshadowed a vast centralization of railroad properties, with all the power involved in such far-reaching combiantions, yet uncontrolled by any public authority which can be efficiently exerted. The restraints of competition upon excessive and unjust rates will in this way be avoided, and whatever evils may result will be remediless under existing laws.

The great increase in business through the country has taxed the capacity of the railroads. Coincidently with this and the centralization of control, rates have been increased, in many cases by very large percentages, and on the necessaries of life. This increase has been complained of to the Commission, but carriers are practically free to make and apply such rates as they choose, whether acting independently or by concert, and whether competing or otherwise, and there is no adequate provision for determining whether such rates are just and reasonable, or for preventing the exaction of those found unjust and unreasonable, although declared by the statute to be unlawful; and the injustice which may result is without available redress.

The conferences which the Commission held with railroad presidents during the year 1899 were for the simple object of getting each railroad to promise to maintain the rates which it had published. Under the law as it now stands the Commission could not successfully prosecute under the criminal clauses and so the roads were invited to these conferences. "Apparently the best means to the end in view was to have personal interviews with presidents of the more important lines for the purpose of securing a pledge from each that his road would adhere to its own published rates. The Commission perfectly understands that competing carriers cannot agree with each other as to what their competitive rates shall be, and then agree with each other to establish and maintain those rates; but the Commission believes it is not unlawful for such carriers to mutually agree that each of them will observe whatever rate it publishes, each of them being perfectly free at any time, by independent and unrestrained action, to publish and apply just such rates as it pleases, changing or reducing the same whenever it sees fit, in the manner prescribed by section 6 of the act. Theoretically it is possible for one road to absolutely conform to its published tariffs whatever its competitors may do in respect of their tariffs, but in point of fact such a thing has rarely if ever happened, and is not likely to happen in the present state of the law. Therefore each road in promising to observe its own tariffs, and intending in good faith to keep that promise, needs the assurance that its competitors will also in good faith observe their tariffs. The mutual and concurrent promises to each other and to the Commission, that each will honestly adhere to its published rates whatever they may be, was practically necessary to accomplish the result desired, which was conformity to the requirements of the act. . . . The charge sometimes made that these conferences were for the purpose of making agreements to maintain rates has no foundation in fact."

The results have fully vindicated the propriety of the conferences. Rates have been maintained better than ever before. The Commission appears to believe, however, that the great amount of business offering has been a more potent element in producing this result than have the promises made by the presidents. Moreover, the unification of the financial interests controlling the railroads has been a great power in this direction.

The Commission next reports its action on the complaints against the new freight classification and quotes its correspondence with the Attorney General, all of which is fresh in the minds of our readers.† The classification was complained of by 334 parties in 73 cities and towns. The Commission has notified these parties that any formal complaint as to specific rates will receive prompt attention.

The Commission reports at considerable length the

* See Railroad Gazette, p. 878.

† See Railroad Gazette, Jan. 5, 1900, p. 1.

decisions which it has rendered during the year. Such of these as are of general interest have been reported in the Railroad Gazette. The number of formal cases before the Commission since the last report has been 23, concerning rates of 292 railroads. The whole number of petitions filed with the Commission during the year was 205. Fifteen civil cases are pending in the Federal courts to enforce orders of the Commission. Indictments for criminal violations of the statute have been found by Federal grand juries and are awaiting trial in Louisiana, Texas, and Georgia.

A chapter is devoted to the action of the Commission concerning safety appliances, which is fresh in the memory of our readers.* Referring to the continued large numbers of deaths and injuries of railroad employes the Commission states the causes as follows: (1) The increased percentage of inexperienced men employed since the decrease which resulted from the panic of 1893. (2) The greater number of tons carried per man employed, owing to the use of cars having greater weight and greater weight-carrying capacity. (3) The use of old and inferior cars, owing to the unusually great demands for transportation facilities on all roads and in all sections of the country. (4) The transition from the link-and-pin to the vertical-plane type of coupler.

A chapter is devoted to the statistical report of the Commission, which has already been summarized in the Railroad Gazette;† and next we have the decisions of the Federal courts during the year on cases originated by the Commission. In the Chattanooga case, the Sixth Circuit Court of Appeals sustained the Commission in deciding that the long and short haul law had been violated; but in the Georgia Railroad Commission cases the Fifth Circuit Court of Appeals took a contrary view. "This decision seems to rest wholly upon the fact of competition, notwithstanding the competitive rates are reasonable to the carrier, and to ignore the ruling of the Supreme Court in the Troy case that all the circumstances and conditions, including the interests of traders and shippers and the welfare of the communities to which the goods are delivered, the shorter as well as the longer distance points are entitled to due consideration."

In the "Live Stock Terminal Charge Case," which involved the legality of a terminal charge of $2 per car on live stock brought into Chicago and destined to the Union Stock Yards in that city, the Circuit Court for the northern district of Illinois refused to sustain the decision of the Commission that this terminal charge was unreasonable and wrongfully prejudicial. The court seems to have overlooked what the Commission believed to be the dominant consideration in the case, namely, that if the through rate to Chicago was a reasonable rate before January 1, 1894, it became an unreasonable rate when the $2 terminal charge was added on that date. To make a reasonable through rate represent less service than formerly and add on another charge for the part of the service formerly covered by the through rate plainly may make the total charge unreasonable, and that, the Commission says, was this case.‡

The United States District Court at Louisville, Ky., refused to issue a warrant authorizing the removal to the State of Texas of certain persons residing in Louisville who had been indicted in Texas for violating the act to regulate commerce by obtaining transportation to points in Texas at less than the regular published rates by means of false billing. The Attorney-General declined to direct the taking of an appeal in this case. Subsequently a like question was presented to the United States District Court sitting in Cincinnati, and although the decision in the Louisville case was laid before the court, and the fact that the Attorney-General had concluded not to direct an appeal in that case was also called to its attention, the court took the contrary view and granted the application for the warrant of removal.

Other decisions are discussed by the Commission in its report under the following headings: "Exemption of Witnesses from Prosecution after Testifying in Proceedings under the Act to Regulate Commerce," "Special Rate Contracts," "Refusal to Obey Shippers' Instructions as to Routing Freight," "Mileage Tickets," "Power of Congress to Authorize a Federal Court to Review the Action of an Executive Officer," "The South Dakota and North Dakota Maximum Rate Cases," "Automatic Couplers." The decision referred to in regard to automatic couplers concludes as follows:

"In view of such mortality, rivaling that of the bloodiest wars, this court cannot reverse its declaration heretofore, which is sustained by every sentiment of justice and humanity, that where a life and limb saving appliance, like automatic car couplers, has come into general use, and its partial adoption has in four years, notwithstanding the increase in railroad mileage and employees, decreased the injuries and deaths from coupling cars one-half, the failure to adopt and use it is negligence per se."

* See Railroad Gazette, pp. 854, 880.
† See Railroad Gazette, 1899 pp. 522, 525, 842.
‡ See Railroad Gazette, 1899, pp. 895, 897.

New York Railroad Commissioners' Report.

The Railroad Commissioners of the State of New York, Ashley W. Cole, Frank M. Baker and George W. Dunn, have issued the 17th annual report of the Board. Following their usual custom, they begin with a review of the general railroad situation, both in and out of New York State. The Board deems the legalization of pooling by Congress desirable. Reference is made to the liability, in consequence of the general prosperity now prevailing, that unnecessary new railroads will be proposed, but the Board appears to stand ready to protect the people of the State and investors against losses, by the exercise of its power to refuse the necessary certificate where a proposed road is not needed by the public. The tendency toward consolidation of large railroads is spoken of; but the Commissioners believe that the State can properly regulate its corporate creatures, whether they are separate or are combined.

The Board has received but few complaints concerning freight rates. The report gives the usual statistics, including statements of earnings for the quarter to Oct. 1 (the rest of the statistics are for the year to July 1). Most of the facts given in the tables include traffic outside of New York, so that as an index of the business of the State by itself the figures are of little value. The length of railroad in the State June 30, 1899, was 8,076 miles, an increase of 11 miles during the year. The taxes paid by the railroads during the year to June 30 amounted to $9,049,639, an increase of about 6 per cent. over the preceding year.

Nine passengers, 203 employes and 492 other persons were killed during the year, and 120 passengers, 853 employes and 353 other persons were injured. Of the employes killed 25 fell from cars or engines, 26 were coupling or uncoupling, 97 were walking on the track, and in 173 cases the casualty was due to "their own misconduct or want of caution."

During the year the Commissioners have passed on 68 complaints; 107 crossing cases, 5 applications for leave to change motive power, 16 applications to build new railroads, two applications for leave to change the gage of steam railroads, and a number of other matters, bringing the total up to 274. The Court of Appeals sustained the Commission in its order allowing the abandonment of a passenger station in Kingston.

Under the grade crossing law, work has been prosecuted diligently. Some new crossings have been authorized where the reasons for so doing seemed overwhelming. Notes are given concerning 41 cases brought before the Board under the law providing that the State shall bear 25 per cent. of the cost of abolishing existing grade crossings. Nineteen crossings have been abolished and 25 more are now in process of abolition. Decisions have been made in 13 other cases and 44 applications are pending. The appropriation made by the State will be more than used up when these cases are settled. A chapter of the report is given to the physical condition of the railroads, and another is devoted to the elevated railroads of New York and Brooklyn. On the elevated roads five passengers, seven employes and seven other persons were killed, and eight passengers and 12 employes were injured.

The principal financial items in the reports of the street railroads of the State are summarized in the following table (cents omitted):

New York Street Railroads.

	For year ending June 30, 1899.	For year ending June 30, 1898.
Capital stock	$151,427,128	$132,844,303
Funded debt	129,524,373	130,179,166
Unfunded debt	37,089,302	31,806,542
Cost of road and equipment	267,388,036	233,635,396
Gross earnings from operation	35,460,822	31,884,384
Operating expenses	21,142,563	19,153,716
Net earnings from operation	14,318,259	12,730,667
Income from other sources	1,636,006	1,457,501
Gross income from all sources	15,954,265	14,188,169
Taxes and miscellaneous	1,779,127	1,459,469
*Interest paid and accrued	6,711,108	6,022,776
*Dividends	7,076,219	5,799,359
Surplus or deficit for the year.	d. 14,063	s. 631,007

The dividends paid for the year by the street railroads average 4.67 per cent.; total number of passengers carried, 920,365,560, an increase over the previous year of 71 millions. This total includes passengers carried on free "transfer" tickets. Twenty-three passengers, 12 employes and 91 other persons were killed on the street railroads during the year and 301 passengers, 62 employes and 226 other persons were injured.

The electrical expert of the Board has inspected many crossings of electric and steam railroads and has made recommendations concerning signals; and during the coming year this officer will examine all such crossings not yet reported on. The Board is not yet ready to report the results of its tests of power brakes for street cars. Street railroads have carried during the year 129,000 tons of feight.

The law of New York now requires that mortgages issued by railroad companies must be approved by the Railroad Commissioners.

*Includes respectively interest and dividends paid by lessors from rentals received from lessees as follows:

	1899.	1898.
Interest	$2,375,560	$1,666,068
Dividends	2,828,892	2,729,894

s. Surplus. d. Deficit.

The Nicaragua Canal.

A favorable report upon the bill for the construction of the Nicaraguan Canal under authority of the Secretary of War has been ordered by the House Committee on Commerce. Colonel Hepburn, Chairman of the Committee, and Judge Barham of California, secured almost unanimous agreement upon the bill introduced by Colonel Hepburn, with the amendments recommended in the last Congress by Judge Barham. The bill provides for control by the United States of the route over which the canal is to be constructed and appropriates $140,000,000 for the work. As finally agreed to the bill is, in the main, as follows:

That the President of the United States be, and is hereby, authorized to acquire from the States of Costa Rica and Nicaragua, for and in behalf of the United States, control of such portion of territory now belonging to Costa Rica and Nicaragua as may be desirable and necessary on which to excavate, construct and defend a canal of such depth and capacity as will be sufficient for the movement of ships of the greatest tonnage and draft now in use. . . .

Sec. 2.—That when the President has secured full control over the territory in Section 1 referred to, he shall direct the Secretary of War to excavate and construct a canal and waterway from a point on the shore of the Carribean Sea, near Greytown, by way of Lake Nicaragua, to a point near Breto, on the Pacific Ocean. . . . And the Secretary of War shall also construct such safe and commodious harbors at the termini of said canal, and such fortifications for defense, as will be required for safety and protection of said canal and harbors.

Sec. 5.—That in any negotiations with the States of Costa Rica or Nicaragua the President may have, the President is authorized to guarantee to said States the use of said canal and harbors upon such terms as may be agreed upon, for all vessels owned by said States or by citizens thereof.

Sec. 6.—That the sum of $140,000,000, or so much thereof as may be necessary, is hereby appropriated, . . . said money to be drawn from the Treasury from time to time, as the same shall be needed, upon warrants of the President, based on estimates made and verified by the Chief Engineer in charge of the work, and approved by the Secretary of War.

The Cost of High Speeds.

At the meeting of the Western Railway Club last week, Mr. F. A. Delano, Superintendent of Motive Power of the Chicago, Burlington & Quincy, presented a paper entitled: "What Does It Cost to Run Trains at High Speeds?" A short summary of the paper is printed now, to be followed by more details when the Proceedings of the Club are published.

Mr. Delano, having in mind passenger trains, divided the cost of operation into the following items:

First—Increased fuel consumption.

Second—Higher grade or standard of machinery, material and service required for extra fast trains.

Third—Increased wear and tear, cost of maintenance of machinery, permanent way, etc.

Fourth—Increased risk of accident by breakage of machinery, injury to track, etc.

Fifth—Increased risk of accident, such as collisions with other trains, and risks taken to avoid collisions.

Sixth—Delay to traffic on account of keeping the road clear.

Each item was discussed in order, but no attempt was made to answer definitely any of the questions involved. Judging from data not given in the paper, it was thought that the fuel consumption per car or ton between 30 and 60 miles an hour increased directly as the speed; the Baldwin Locomotive Works train resistance formula would indicate something like an increase of 62½ per cent. between these limits. Under the second heading it was stated that the very best equipment is used for fast trains, additional cost is incurred to inspect and keep this equipment up to a high standard and guard against failures and delays. The fast schedules affect appreciably the wear of machinery, rolling stock and track and this is shown best by the record of engine failures, which are more for passenger than freight locotives in proportion to the respective train mileage; then it is found that very nearly all the passenger engine failures occur in special fast passenger or mail service.

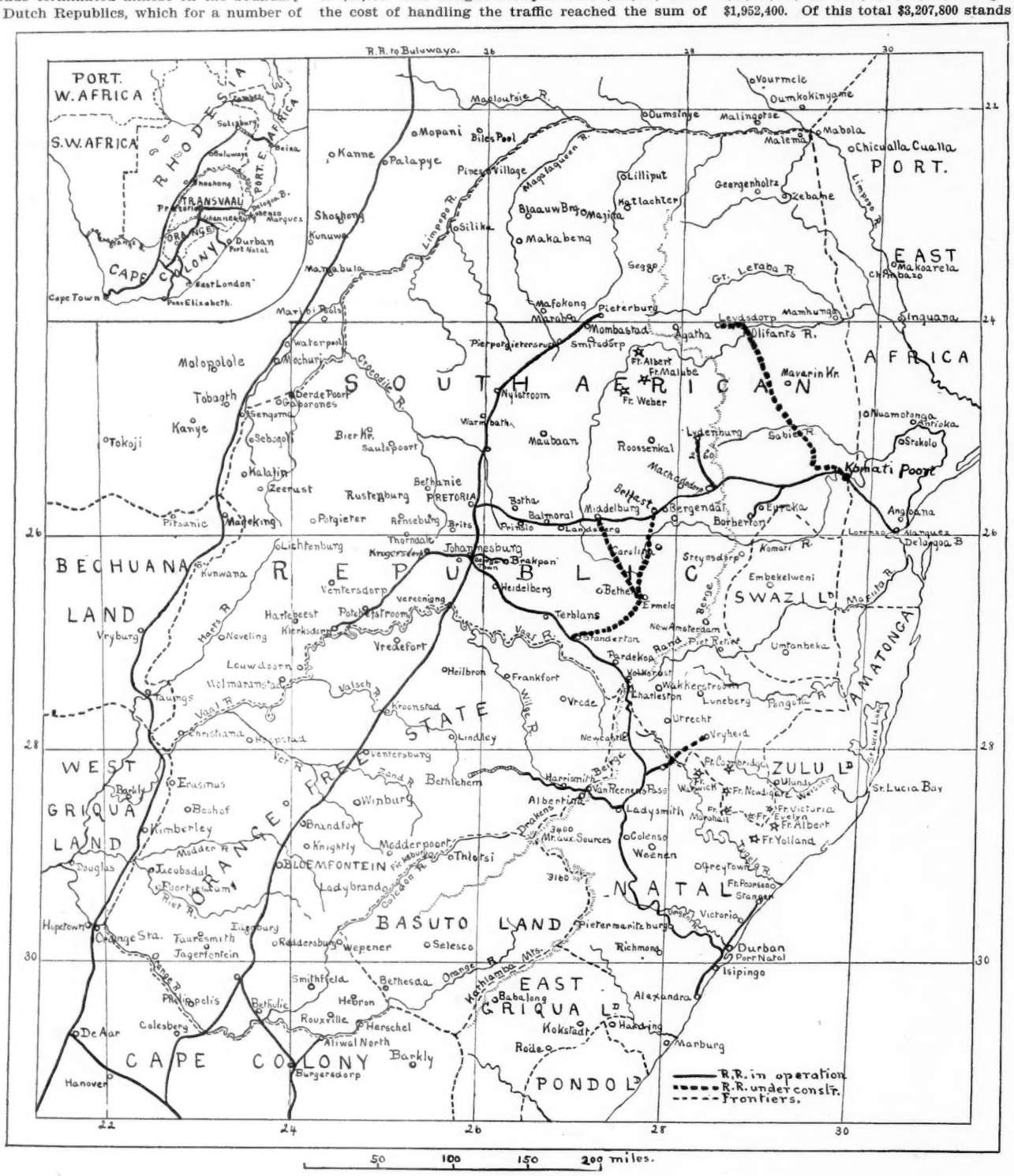
By great vigilance the accidents in high speed service have been reduced to a comparatively low figure, but the risk increases rapidly with the speed. The risk of accidents to other trains is also an unknown quantity, difficult to determine. If it were not for the high speed trains it would be unnecessary to go to the expense of installing block signals. The delay to other traffic occasioned by fast trains is considered the most serious factor of the problem. It is well known that the way to do a maximum amount of business over a piece of railroad is to have the speed of all trains as nearly uniform as possible. This is instanced in the case of elevated and street railroads, where on holidays and special occasions the business handled is astonishing to one accustomed only to steam railroads. A fast train

running on a road with much slower trains necessarily makes a wide gap in front and back of it. One General Superintendent has recently stated that the cost of operating an extra fast train was $2 per train mile, and Mr. Delano is inclined to think it is none too high.

In the discussion of this paper Messrs. Henderson, Rhodes, Goss and Clark agreed fully with Mr. Delano. Mr. Marshall suggested that all possible means should be taken to reduce the time lost by stops before passenger train schedules are lowered. Mr. Deams expressed the general opinion that fast schedules key the service up and improve it generally.

The Railroads of the Transvaal.

Prior to the end of 1890 the railroads of South Africa were confined to the British Colonies, with the exception of a short line reaching from Delagoa Bay into Portuguese territory. At four different points railroads terminated almost on the boundary lines of the Dutch Republics, which for a number of years proved an impassible barrier to further advance, owing to the prejudices of the Boers. This prejudice has, however, of late years been overcome, and a reaction has set in which, until the war broke out, promised in a few years to cover the Orange Free State and the Transvaal with a network of rails.



The Railroads of the Transvaal.

The Transvaal Railroads, owned and operated by the Netherlands South African Company, are 717 miles long, 46 miles of which was completed in 1897. These figures include the line from Krugersdorp to Klerksdorp now completed, but not that from Pretoria to Pietersburg, which was opened to traffic in June, 1899. The roads of the Pretoria-Pietersburg and the Machadodorp-Lydenburg lines have been terminated and work on the Middleburg-Ermelo line as well as that from Vryheid to the frontier of Natal was being carried on up to the outbreak of war. Work on the Salati line has not, however, been again taken up. Altogether in 1897 there were 696 miles of road in course of construction, and in 1898, 718 miles.

In connection with the Pretoria-Pietersburg line mentioned above, the only railroad in operation in the Transvaal not controlled by the Netherlands South African Company, it may be well to state here that although not officially opened to traffic until June, 1899, the road carried during the latter half of the year 1898 any passengers and freight that offered, as far as the incomplete state of the line permitted. The line now has a total length of 178¾ miles, gage 3 ft. 6 in., 137½ miles of which were completed on the 1st of January, 1899, the remaining distance being ready, as already stated, in June of the same year. During the last six months of 1898, the line carried 3,789 first class passengers, 11,927 second class passengers, and 26,034 negroes, the receipts amounting to $77,735. The freight receipts were $141,215, while the cost of handling the traffic reached the sum of $137,715, thus leaving the company a profit of $81,235.

According to the official statistics recently given out by the Netherlands South African Railroad Company, the traffic of all that company's lines combined amounted in 1898 to 610,304 first class passengers, 469,561 second class, and 621,121 colored third class passengers, while the issue of complimentary tickets numbered 17,153, making a total of 1,718,139 passengers. The total for 1897 was 100,529 higher than the 1898 figures. This is an increase of business of something like 245,000 for 1897 over 1896 and of 145,000 for 1898 over 1896.

Fares on the Transvaal railroads are computed on a basis of six cents, five cents and three cents a mile, according to the class, the third class being patronized entirely by negroes. No advantages whatever are given to commercial travellers, except as regards baggage. The return tickets cost about 1½ the prices of a single ticket, but third class return tickets do not exist. The time for which return tickets are available is as follows: Up to 25 miles, four days; from 25 to 100 miles, eight days; to 250 miles, fourteen days; to 400 miles, one calendar month; over 400 miles, three months; Sundays and day of issue being included.

On local trains 50 lbs. of baggage is allowed to all classes, and on through trains 75 lbs., according to class, registration being free. Commercial travellers are allowed double the usual amount of baggage and excess is charged at half the parcel rates.

In freight the Netherlands Company carried in 1897 1,509,073 tons of freight, as compared with 1,669,034 tons in 1898. Then there was a decrease of 72,882 tons in 1897 and an increase of 87,079 tons in 1898, compared to 1896.

The entire receipts of the company for 1897 were $15,040,400; in 1898, $13,088,000, being a decrease of $1,952,400. Of this total $3,207,800 stands for the earnings of the passenger department in 1897; in 1898 the earnings were $2,877,400. The receipts of the company increased by $522,800 in 1897, but decreased $1,429,600 in 1898, as against 1896.

At the instance of the Government, the freight charges for coal and food products were considerably reduced in 1898, the loss in revenue to the company being more than $1,000,000.

The working expenses of the company, including amounts set aside for the reserve fund, amounted to $6,734,740 in 1898, as compared with $7,590,220 in the previous year. The average results of the traffic were as follows:

	1897.	1898.
Per mile	$8,359.69	$6,890.60
Per day-mile	22.90	19.42
Per train-mile	2.33	2.03
Expenses per train-mile	1.18	1.07

The following table represents the state of the company's profit and loss account:

Receipts.	1897.	1898.
Balance of previous year	$10,850	$340
Balance of special account, Article No. 33 of the concession	5,961,875	5,304,030
	$5,972,725	$5,304,370
Expenses.	**1897.**	**1898.**
Interest and amortization of obligations	$1,578,125	$1,485,700
Amortization of a loan of £200,000	104,235	105,430
Excess of profits for distribution	3,580,440	3,043,485
Paid to shareholders on investment of 11,000,000 florins	595,835	538,540
On 3,000,000 florins	143,750	128,125
Balance to be carried forward	340	3,090
	$5,972,725	$5,304,370

The above mentioned special account (article 33 of the concession) is established as follows:

Receipts.	1897.	1898.
Traffic	$14,635,280	$12,726,560
Telegraph	26,790	26,660
Product of the coal mine	300,240	372,935
Miscellaneous receipts	378,390	350,080
Interest on funds loaned	69,575	37,915
Loss on the line Klerksdorp, reimbursed by reserve fund	33,895	65,235
	$15,444,175	$13,579,385
Expenditures.	**1897.**	**1898.**
Expenses of operating lines	$7,590,220	$6,734,740
Expenses of working coal mine	222,060	216,895
Expenses of locating cars of other companies	158,325	.....
Eight per cent. of gross receipts for the reserve fund of the Krugersdorp-Boksburg Line	89,515	89,515
One per cent. of gross receipts for the reserve funds of other lines	1,422,175	1,234,205
Excess receipts	5,961,880	5,304,030
	$15,444,175	$13,579,385

After the deduction of these excesses, $5,961,880 in 1897, and $5,304,030 in 1898, from the sums required for the payment of interest and the amortization of obligations and the dividend guaranteed to shareholders, amounting to $1,983,615 in 1897, and $1,922,380 in 1898, there remained a balance for 1897 of $3,978,265, and for 1898, $3,381,650, which was apportioned in the following ratio:

	1897.	1898.
Eighty-five per cent. to the Transvaal Government	$3,381,525	$2,874,405
Five per cent. to the management of the company	198,915	169,080
	$3,580,440	$3,043,485
Leaving a surplus of	397,825	338,165
Thus the sums of	$3,978,265	$3,381,650

were distributed in 1897 and 1898 as supplementary dividends.

The detailed list of expenditures for the actual operating of the company's lines is comprised in the following table:

	1897.	1898.
General expenses	$996,860	$850,960
Maintaining and superintending tracks and work	1,545,670	1,437,755
Traction and material	2,587,165	2,185,200
Transportation and road employes.	2,193,550	2,041,760
Service to Lourenco Marques	44,645	25,040
Expense at Custom House station	31,130	32,160
Cartage	191,200	161,865
	$7,590,220	$6,734,740

On the first of January, 1899, the rolling stock of the Netherlands South African Railroad Co. consisted of 228 locomotives, 234 passenger cars, 67 baggage vans, 5,112 freight cars and 56 special cars for various uses. On the same date the company was giving employment to 3,214 whites and 4,497 negroes.

The company operated, up to last year, a coal mine, the production of which in 1898 amounted to 157,885 tons, which realized for the railroad a profit in 1898 of 0.978 cent per ton, or $156,040. In March, 1899, however, a fire broke out in the company's mine, which spread with such rapidity and violence that it was found necessary to abandon the mine.

In order to illustrate clearly the steady growth of the Netherlands Company since the beginning in 1890, the following table of the number and quantity of passengers and freight handled from 1890 to 1898 will perhaps best serve the purpose:

Passengers—Number.

1890	66,176	1896	1,573,950
1891	247,603	1897	1,818,668
1892	430,021	1898	1,718,139
1893	726,997		8,487,643
1894	835,491		
1895	1,070,598		

Freight, in Metric Tons.

1890	61,341	1895	1,020,564
1891	150,721	1896	1,581,955
1892	351,571	1897	1,630,849
1893	723,938	1898	1,749,098
1894	965,005		

Although not in the Transvaal, a railroad that seems destined to exert future influence on the railroads of the Dutch Republic is the Rhodesia line from Vryburg to Buluwayo. This is an extension of the Cape Government railroad which starts at Cape Town, traverses Cape Colony and passing Kimberley, Warrentown and Taungs, forms a junction with the Rhodesia line at Vryburg. It is along this line that Lord Methuen is advancing. The Rhodesia line is 580 miles in length, with a track gage of 3 ft. 6 in. Although there is yet no line that connects the Rhodesia Railway directly with the Transvaal, Vryburg is so situated that one of the steps to be taken in the near future in railroad construction will be to connect the Netherlands South African Company's line at Klerksdorp or Pretoria with Vryburg, and thus establish a more direct means of communication between Pretoria and Cape Town.

The United States Consul-General at Cape Town, Mr. J. G. Stowe, made during the summer of 1899 an extensive tour through South Africa. Consul Stowe describes his railroad experiences on the trip, and speaks in flattering words of the roads and accommodations of South African lines. We quote Mr. Stowe's words in part:

"For two days and one night I rode over these wastes in the compartment cars of this country; at night furnished with a bed consisting of one sheet doubled, one small pillow. and two blankets, made up on the seat, for which I paid 10s. ($2.43).

"The City of Kimberley is 647 miles from Cape Town—a ride of two days and one night. I was pulled to Kimberley by an American locomotive, and there are several others now in use in Cape Colony. . . . Leaving Kimberley a ride of 167 miles brings one to the borders of the Orange Free State. . . . On the border of the Transvaal we were held five hours for the examination of baggage. We then took the train of the Netherlands Railway, and proceeded to Pretoria, a distance of 77 miles. The next day I reached Johannesburg. I never rode over a better roadbed or in more comfortable cars. They are equipped with all modern conveniences, and the dining cars reminded me of home. The cars are all of iron, even the covering and sides, and in warm weather, I am told, are like a furnace; but no better equipment, as a whole, can be found anywhere."

In the Transvaal and Bechuanaland the enormous passenger traffic and want of railroads some years ago led to the organization of some splendidly-appointed coach services which formerly connected Johannesburg, Pretoria, etc., with the South. These now run from the railroad termini to Rhodesia or elsewhere. The conveyances usually employed are the American saloon coaches slung on leather straps carrying twelve inside and six or eight outside, with teams of ten horses or mules. Where American coaches are not used they are replaced by Cape carts, a high, two-wheeled spring vehicle in universal use throughout South Africa. Teams are changed every ten to fifteen miles, and some idea may be inferred of the number of horses and mules kept at the different stations from the fact that frequently four or five coaches will require fresh teams at one place during the day. Fares are very high, ranking from 18 to 24 cents per mile. The allowance of baggage per passenger varies from 25 to 40 lbs. Every additional pound weight is charged eight cents to thirty-six cents extra, according to the distance traversed, while, if the mail should happen to be heavy, baggage is frequently shut out. H. L. G.

Jan. 15, 1900.

The Work Ahead.*

As I desire to contrast the past and future, I am obliged to make a few remarks regarding the past and the kind of work of which we shall see but little more. If you care to examine the current publications from 1820 to 1870, you will notice frequent discussions relative to new railroad projects. You will also notice accounts of the celebrations so universally held on the completion of the lines. The year 1857 was a year prominent for its railroad celebrations, so much so that a book has been published describing the great celebrations of that year. I speak of these incidents to call attention to the fact that this was enthusiasm based upon the solution of a physical problem, the laying of the track and the running of cars. In our time we shall see little more of such jubilations and it is not probable that there will be many new important lines built, for few communities are now without adequate means of communication. Our work is largely with the improvement of the existing lines; improvement in physical construction, improvement in operation and in financial results.

First and foremost, railroad managers are accomplishing more work with less men. This is being done in many ways; through larger trains, larger cars and through improved methods of handling cars at terminals. Again, managers are especially anxious that all grades of employes should be better schooled than was formerly thought possible. The so-called Brown discipline, having for its purpose the recognition that all men are human, and to retain a man in service notwithstanding some temporary mistake, is one of the improvements worthy of mention of the past decade. This system is largely in use throughout the country. A step further in regard to better relations between railroads and their employes has just been taken in the establishment of the pension fund by the Pennsylvania, and an insurance fund has for some time been in existence on this and several other of the larger lines. The relations between employes and officers are capable of further evolution.

It may fall to the lot of some of you to become an officer in charge of the department of maintenance of way. It was not until the past few years that Mr. P. H. Dudley established the fact that more cars could be hauled on a track of stiff and heavy rails than of equally well-kept light rails. This is seemingly a small matter, but on a trunk line small matters become large ones, small savings in economy become large matters. The end is not yet in sight where we can say that we have reached on any of our lines a perfect track, considering repairs and renewals. In other words, while the track itself in many instances is good, we have yet to study how we may retain its condition at less expense.

A problem of magnitude, largely the work of the officer of maintenance of way in the future, will be the readjustment of terminal yards to increase efficiency and to avoid delays. If you examine some of the modern freight yards in comparison with the accumulation of side tracks formerly called yards, you will find one switch engine performing the work formerly required of several. You will find through cars received and delivered with promptness. Another problem which is worthy of wider operation is that of freight transfer stations, avoiding the hauling of less than car-loads over long distances. Not long since, the Pennsylvania established transfer stations at Harrisburg, Columbus and Fort Wayne for this purpose. A small shipment from New York to a local station, we may say near Pittsburgh, is placed in a car fully loaded to the Harrisburg transfer station. The local haul is from Harrisburg instead of from New York. The number of cars required to handle local business from this apparently trifling innovation has been surprising.

I judge a number of you will give your attention to matters relating to equipment. Your problem will there be to move the same number of cars at less expense, at higher speed, with less train and engine mileage. There is no better instance of what gradual improvement from year to year has accomplished than in the locomotive, which is in principle and general construction not greatly different from the engines of fifty years aog, but far more efficient in every detail. The problem of increasing the miles of service during the month is one that will always present itself. It used to be thought that about ninety miles was as far as a locomotive could go before it required a rest for examination. We have now progressed from that idea. It is hardly probable that we shall obtain the efficiency and endurance of marine engines, but we shall come nearer to it in the locomotives of the future than we have in the past.

It is now the custom for railroads to pay for the hire of foreign cars on a mileage basis, with but limited exceptions, but the time will come to perfect a scheme so that cars will be paid for on the per diem basis. Although this plan has been recommended and urged in various quarters, some roads fear the details of the plan would prove an injustice to them and have prevented its general adoption. No doubt this plan when carried into effect will materially increase the annual mileage per freight car throughout the country, or, in other words, enable one thousand cars to possibly do the work now required of twelve hundred or more. In this connection it is not out of place to call attention to how much the Railway Clearing House in England has simplified the work of interchange of traffic among the various lines. The saving of clerical labor and increased efficiency obtained through that system in comparison with the clumsy methods formerly in vogue, is hardly comprehensible except to one who has given the matter close study. Should any of you have an opportunity to institute such a great economy in railroad operations as would follow after the adoption of the Railway Clearing House, you will have the satisfaction of feeling that your work is of lasting importance.

The standard code of train rules adopted by the American Railway Association and in use on practically all railroads of the United States, is a striking instance of the progress that can be made when close and united attention is directed upon the improvement of any inefficient method. Improvements will continue in the standard code, no doubt, and rightly should, but no one will say that the improvement of those rules over the condition that existed before is not one which reflects great credit to its makers, although the ideal has by no means been reached.

I understand the instruction at Purdue largely deals with the mechanical side of railroad operation. I do not wish there was less of that, but that there was more of the other departments, more about traffic and more about transportation. Experience must, in many departments of a railroad, be the chief teacher, but I feel that in all departments a good deal that experience alone could teach the first generation can now be formulated and more clearly impressed upon the generations to follow. The early officers of railroads were all men who had learned what they knew by experience. That was equally as true in the department of mechanics as in any other. It may not be possible to teach quite as much in other departments, but something can be done.

* Extracts from a lecture at Purdue University by Mr. G. B. Leighton, President of the Los Angeles Terminal RR.

In the Batignolles tunnel of the new Paris City Railroad the cars are to be lighted from the outside. Electric lamps of 10 candle-power are to be set in the walls of the tunnel just at the height of the car windows and only one metre apart. The entrance of a train into the tunnel turns on the light, and the passage of the rear car of the train out of the tunnel turns the light off.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to improvements. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The current reports concerning the harmonious action of the New York Central and the Pennsylvania, both toward each other and jointly in their attitude toward weaker trunk lines, were noted in these columns last week. Positive confirmation of these reports is still lacking, except that Mr. Ingalls, President of the Chesapeake & Ohio, tells the newspapers that he and the others, who, with him, controlled that road, have sold out their controlling interest. He is not to retire from his other road, the Cleveland, Cincinnati, Chicago & St. Louis. This statement as to a sale is confirmed by reports from Philadelphia, apparently authentic, that the Pennsylvania has secured a large interest in C. & O., which thus ceases to be a Vanderbilt road. At the annual meeting of the Baltimore & Ohio, this week, it was expected that the election of directors would disclose a strong Pennsylvania interest in that company, but at this writing the result of that meeting has not been reported.

The criticism made (on another page) by "W" of Mr. Higgins' paper on the "Education of Machinists and Foremen" is, in some measure, sound, but one important conclusion which he reaches does not seem to follow necessarily from his reasoning or from the observation of daily experience. He believes that manufacturers will get better results by taking boys with common school education and training them for their own uses than they will in taking boys from such schools as Mr. Higgins proposes. It will be remembered that he would connect with the school a commercial machine shop, where pupils would be instructed half of the working hours of each school week. He would give to every pupil training in drawing and machine design, and try to fit the boys to take places as skilled machinists and as shop foremen with the idea that those who have superior intellectual and moral qualities would rise to be mechanical engineers. But why should the training which Mr. Higgins suggests unfit a boy for duty as a machinist or as a foreman? Why should he not be all the better for having learned to draw and to use tools, and for having learned what the inside of a machine shop is actually like?

The complaints which are being worked up by the merchants of New York, Boston, Detroit and a dozen other cities against the revised Trunk Line freight classification, and which are to be considered by the Trunk Line Committee at a hearing to be held in New York next Monday, bid fair to give the question of rate making a more extensive airing than it has been subjected to for a long time. Each complainer is interested chiefly in one commodity or small group of commodities and has little or nothing in common with the others; but the presentation of such a mass of protests all at once will make it almost necessary for the railroads to consider the subject of classification and rates on the broadest possible lines. It is to be hoped, therefore, that the interminable complexity which characterizes the freight-rate field will be thoroughly shown up and explained, so that those people who are still keeping up the demand for uniform classification throughout the country may see the unreasonableness of their view. It is difficult to believe that all of the persons who advocate uniform classification adequately realize what a disturbance they are trying to produce; but they all seem to evince a persistency that one would expect to find only in a great and righteous cause. It is true, however, that most of the published demands for uniformity come at second hand, as it were; that is, from Federal or State commissioners or merchants' freight bureau managers or similar functionaries, who are not personally suffering loss or inconvenience from present practice. It would not be fair to say that these men are open to the suspicion of keeping up this agitation because it had some merit a dozen years ago or because live grievances are now scarce; and yet their arguments generally seem to have a hollow sound. One of these gentlemen, Mr. Kelly, of the Philadelphia Trades' League, has very frankly recognized the present situation. Being asked to join in requesting the Attorney-General to complain of the changes which have been made by the railroads, looking toward better uniformity in and more rational adjustment of the freight classification, he declined, saying:

"Most of the commercial organizations in the country, as well as the Interstate Commerce Commission itself, have been for several years past petitioning Congress for the establishment of a uniform freight classification. The Trades League of Philadelphia is one of the commercial organizations that has been actively identified with this widespread movement to secure a uniform freight classification throughout the country, and by giving my approval to the petition requesting the Attorney-General to proceed against the Official Classification Committee I should be practically stultifying myself. While some shippers will suffer considerable hardship under the new classifications if not modified, the Official Classification Committee upon proper presentation of the facts will probably modify many of the increases. Traffic officials of the various railroads give assurance that the Classification Committee will take up and consider the various protests of shippers and commercial organizations. By advising and co-operating with the railroads to secure the harmonious adjustment of this important question upon a basis which will be entirely fair and equitable to all the interests concerned, we shall accomplish much more than shippers can if they unnecessarily antagonize the carriers by legal proceedings at this time."

Mr. Gill and his committee have, without doubt, endeavored to make a classification which will be acceptable to as large a number of roads as possible. In doing this they are working in the direction of uniform classification, which the Interstate Commerce Commission continues to demand; but, as appears from the complaints now arising, and as has been evident all along, this course is not calculated to please the shippers. If merchants desire uniformity they cannot consistently demand the lowest possible rate in every instance. One way to make a uniform classification would be to put all articles in sixth class. But as the merchants concede in a general way that railroad rates should be increased, it cannot be assumed that they desire a sweeping reduction. In such a contradictory state of affairs the only rational explanation possible is that each shipper desires uniform classification on one condition; the condition that all the changes which are necessary shall be reductions. The railroads did a lot of unifying on this principle in 1887, in order to make sure that on the advent of the long and short haul law every rate should conform to it; and it looks now as though they then went too far. But in the dozen years since that time, instead of advancing any of the rates which had been too much reduced, they have made further reductions, in the shape of thousands of commodity rates. In the general prevalence of competition this wide-spread reduction was, of course, unavoidable, and we are not trying to blame anybody for it; but it must be remembered that there is no good reason in economics or business for keeping up this process forever. The unification of classifications in 1887, with the resulting necessity, within a few years, of thousands of commodity rates, shows the utter futility of trying to apply the process to any larger territory than it has already been applied to. It seems quite probable that the welfare of the shippers and the railroads alike would be promoted if the use of the same classification on both through and local business were to be abandoned. The roads east of Buffalo, Pittsburgh, etc., probably earn from 75 to 90 per cent. of their freight receipts on merchandise that never was west of those cities and never will be. This being the case, the use of a single classification for all shipments may mean the use of an unjust rate on nine dollars' worth of business in order to be able to use a fair one on one dollar's worth. We do not, of course, expect any merchant to take much stock in the arguments which we here present, but we do think that a good many merchants ought to abandon their advocacy of uniform classification.

Concerning Front Ends and Exhaust Nozzles.

Not long ago Mr. J. Snowden Bell presented a paper on locomotive front ends before the Western Railway Club, and as we noted at the time, it was unfortunate that Mr. Bell or others having experience with short locomotive fronts were not present at that meeting. As a result of their absence the discussion was one-sided, and so favorable to extension fronts and other old-time notions as to be misleading if taken too seriously. That the discussion at this meeting really did not bring out a correct expression of opinion is now clearly shown by the excellent report on draft appliances made by Mr. C. H. Quereau to the International Railroad Congress. Every motive power man should secure a copy of this report, as the extracts which we can reprint give, necessarily, only the most essential parts.

There are several things about this report which we would emphasize. First, the conclusions are based on the experience of leading roads owning about 15,000 locomotives, and the facts plainly are presented without prejudice.

Then, Mr. Quereau, in his discussion, takes a broad view and brings out clearly the fact that general principles are too frequently overlooked in matters of draft appliance. He holds that there is no reason why the most efficient design of front end, when determined, should not apply equally as well whatever the locality and whatever the grade of coal; the only reasonable change in the design which should be allowed is to increase or decrease the vacuum to meet the necessities of any case, by increasing or decreasing the back pressure. This would resolve itself into an adjustment of the exhaust opening. No claim is made that this most efficient arrangement has yet been found, but it is believed that it is within the range of possibility, and when once found should prove universally the most efficient arrangement.

Another point is that such matters as the proper arrangement of draft appliances can best be studied on locomotive testing plants and that the results there obtained apply directly to engines in service. Also, in determining the efficiency of any particular design, the back pressure and vacuum must both be considered; tests such as those made at Hanover, Germany, where vacuum measurements alone were taken, are of doubtful value.

What will interest Mr. Bell and others who have long urged the abandonment of the extension front, is the conclusion that the front end should be as short as possible, and the fact that within the last ten years sixteen out of twenty-five roads reporting have shortened their extensions an average of 17 in. In addition to this, tests have shown the extension front to be a failure as a cinder receptacle, for which it was originally intended.

Taper and straight stacks are said to be more efficient than diamond stacks, and it is thought that taper stacks are probably better than straight ones; the most efficient proportions for stacks, however, are yet to be worked out. While variable exhaust tips have so far not been successfully used, it is thought a permanently successful design should be automatic and beyond the control of the engineman, possibly being connected with the reversing gear.

In the above we have tried merely to touch on some of the high spots of this report, which is in accord with the best general opinion on draft appliances. In such a paper it would, of course, be out of place to record all the conflicting opinions and practices.

Annua Reports.

Lehigh Valley.—Railroad annual reports for several years past have formed such an unbroken record of improving fortunes, large earnings, new and increased dividends, etc., that it is a surprise to find a large company reporting a material deficit for the past year, as against a surplus in the previous twelve months. This record is made by the Lehigh Valley in its annual report for the year to Nov. 30, issued last week, the deficit of the railroad company (which earned over 21½ million dollars gross in the year) being $523,194. The company shared, however, quite fully in the better business of the year, which brought more activity to the anthracite producing and carrying interests than they experienced for a half dozen years. The gross receipts of the Lehigh Valley Railroad Company gained $1,826,000, and those

of the Coal Company, $2,125,000. Larger expenses more than absorbed this gain in the case of the railroad company and the result was not much different with the coal company. A larger coal output and traffic movement necessitated an expansion in working charges, but the main increases were on account of the plans for improving the equipment, roadway, and buildings of the companies.

New additions and betterments made during the year and included in the railroad company's expenses cost $1,529,884, as compared with $572,400 expended on the same accounts in 1898. Colliery improvements cost $300,000, so that these two items, representing new work, would offset the combined deficit of the two companies, amounting to $782,465, and show a balance to the good of $1,047,419. This makes no allowance for the charges on equipment account, which have been abnormally heavy in the past two years. The Lehigh Valley 1899 deficits, therefore, are attributable to the extensive scale on which improvement work has been carried out. This has been a notable feature of the past year with practically every important company, although no other has carried it so far as to turn a surplus balance, accruing after the ordinary expenses, into a deficit.

The main energies of the present management since it took office, something over two years ago, have been devoted to efforts to bring the property into condition for economical working. Much has been done and much is to be undertaken before the management will be ready to say that this work of betterment has been accomplished. With the cessation of the abnormal charges for such work, which are being met out of current earnings and without the issue of new capital, or the creation of floating debt, the net earnings in ordinary course will be materially improved.

The outline which President Walter gives of his policy in this particular, and his account of the work already accomplished, and remaining to be done, are an interesting contribution to the record of railroad progress. The heavy expenditures of the past year have enabled the management to make considerable progress in substituting heavier engines for lighter ones, and in retiring the four-wheel coal cars, of which there were 12,300 in service at the beginning of the fiscal year for which this report is made.

Railroad improvements have included the construction of additional passing sidings, the lengthening of many other sidings, and the enlargement of yard tracks. Heavier bridges have replaced lighter structures, and much work of this sort on the main line is outlined for the present year. The block system has been extended, and the work is to be continued until the remaining 634 miles of main line track is protected.

The concentration of shop work, which has been an important part of the progress of the past year is to be pushed still further, and the relief of traffic in the more congested parts of the line by building additional tracks, or alternative lines where that course seems more advisable, is contemplated.

During the year important changes took place in the equipment account. Of the four-wheel coal cars in service, 6,811 were demolished. They were replaced (through a car trust, of which $1,000,000, out of $2,000,000 authorized, was issued on Nov. 30) by the purchase of 1,000 50-ton steel, and 1,000 40-ton wooden cars, and in addition 400 box cars were built. While 28 light engines were condemned in 1898 not much seems to have been done in this direction in the past year. The inventory still contains a number of locomotives, too old or too light to justify further repairing, and these are to be withdrawn this year. The total equipment expenses ran up to $3,504,350, an increase of $378,323 (12 per cent.). This was made up by $139,517 increased charges for rolling stock destroyed; $144,977 due to increased cost of materials; $58,736 for new machinery and shop expenses; $14,643 for M. C. B. couplers, and air brakes; $28,440 for enlarging the size of locomotive tenders; and $94,000 increased repairs to equipment damaged in accident.

Summing up the year's operations so far as they are carried in the increase account, it appears that gross earnings increased $1,827,964, or 9¼ per cent.; expenses of operation (excluding taxes), $2,675,458, or 19.2 per cent., and net earnings decreased $847,494, or 14.7 per cent. Coal tonnage contributed more than half of the improvement in receipts, as will be seen by the following table giving the division of earnings and expenses:

	1899.	1898.	Inc.
Coal cars	$9,553,950	$8,436,392	$1,117,558
General freight	8,236,505	7,571,978	664,527
Passenger cars	2,760,401	2,718,858	41,543
Total gross	21,570,502	19,742,538	1,827,964
Expenses:			
Maintenance way	$3,354,304	$2,036,050	$1,318,254
Maintenance equipment	3,504,350	3,126,027	378,323
Conducting transportation	9,222,095	8,242,906	979,189
General expenses	568,080	568,388	‡ 308
Taxes	650,639	574,357	75,782
Total	$17,299,468	$14,548,228	$2,751,240
Net earnings	4,271,034	5,194,310	‡ 923,276
Total net income	5,388,762	6,439,256	1,050,496
Charges	5,911,957	5,965,151	‡ 53,194
Balance	* $523,195	† $474,105	‡ $997,300

* Deficiency. † Surplus. ‡ Decrease.

Southern Pacific.—The annual report of the Southern Pacific for the year to June 30 last is only now issued, having been delayed to include some account of the readjustment of affairs of the Central Pacific and to permit an audit of the books by independent accountants. The first place in the events of the year is taken by the merger with the Central Pacific, although technically this has occurred since June 30. The readjustment of that company's subsidy debt to the Government left the way clear for its financial rehabilitation. This was promply carried out by the retirement of the old capital. All of the new stock was acquired by the Southern Pacific, which issued $28,815,500 of its own bonds and $67,274,000 new stock to conclude the purchase. Another change of the year, not mentioned in the report, because it does not affect the corporation as such, although it may have an important bearing on its future, is the practical retirement of the Stanford and Crocker interests in the property. A very large portion of the latter holdings, and what is understood to be practically all of the Stanford houldings, have been sold to New York bankers who have important connections in Europe where the shares are likely to find a market.

The income results of the year were quite satisfactory. Although the increase in gross receipts in the 1898 fiscal year ran up to the extraordinary total of $7,426,000, an additional gain of $3,765,300 was made in 1899. This, however, was absorbed by increased expenses, and net earnings show practically no change, the difference being only $362,400. The increased maintenance charges do not fully represent the cost of improvements and additions to the property carried out during the year, for large appropriations were made out of the surplus income for such betterments, as in previous years. The deductions last year were exceptionally large, being $2,914,300, against $1,300,000 in 1898 and $907,000 in 1897. In addition there was considerable issue of capital to provide for new equipment, etc. Excluding the improvement appropriations against income, a balance of about $5,000,000 was shown above fixed charges on the year's operations.

The comparisons for the year follow, the 1899 figures including the Houston & Texas Central lines (which are no longer reported in the Southern Pacific accounts, to meet a State law) so that the comparisons may be preserved. Excluding the Houston & Texas Central and its subsidiary Texas lines, the actual income balance was $4,478,000, the final surplus being $1,747,568. Taking the Texas lines out of both years' figures, gross earnings show an increase of $3,249,000, or 6½ per cent., operating expenses increased $3,370,083, or 10⅛ per cent., and taxes and fixed charges $431,713, of which $403,500 was incidental to the Central Pacific readjustment. This has been so effected that there will be no material increase in Southern Pacific's annual charges, although for the first time the whole interest on the United States subsidy debt is being met. Besides the charges against current income for improvements and betterments, the capital expenditures on the same accounts brought the total cost of the new work of the year up to $6,173,000, divided as follows:

New equipment and improvements on proprietary lines	$2,577,331
New equipment and improvements on leased lines	559,729
Total charged against income	3,137,060
Construction and betterments charged against new capital	3,035,950
	$6,173,010

Earnings provided $1,646,790 of the $3,000,000 charge against capital. Of the capital expenditures $1,071,258 represented the cost of construction work, chiefly in California, and $2,572,730 the cost of 35 locomotives, 1,094 box cars and other new equipment. The betterments provided by earnings included the ballasting of 142 miles of track, etc., at a cost of $215,329; 39¼ miles of additional side tracks, $220,413; heavier bridges, $155,577; new buildings, $199,664, and new equipment and machinery, $1,313,782.

The largest portion of all these extraordinary charges was for new equipment. The notable work of the year has pertained to this development rather than to roadway improvements. The demands of the improving business of the country were anticipated and orders for a considerable amount of rolling stock was placed before there was any material advance in the price of material. The new equipment received during the year (not all additions) embraced 83 engines and passenger coaches and 35 other passenger equipment cars, 2,113 box cars, and 737 other freight cars. There still remain to be delivered 11 engines and 1,235 freight cars. Of the new rolling stock, 2,000 cars are of 50 tons capacity.

The general operating results are given in a new form, showing succinctly the year's history, as comprised in the statistics of earnings and expenses, and the work performed. An analysis of the operating expenses, showing the division of the account among the different items per unit, that is, maintenance of way expenditures per mile of road, cost of equipment per locomotive and car, and transportation expenses per train and traffic mile, has been introduced this year.

Few other reports so carefully make the proper distinction as to what is comprised in the train mile and train load figures. This distinction has, in fact, been stated in the company's earlier reports, but in the present issue it is recognized in the statistics which are based on both actual train miles run, irrespective of the engine mileage required, and with light and helping engine mileage included. As the Southern Pacific has heavy grades, there is a good deal of helping locomotive mileage. How it affects some of the averages may be seen by the fact that the average load reported per train mile is 246.9 tons and per traffic mile 225.9 tons. The Southern Pacific gets low rates on both its passenger and freight traffic. The latter figure, which dropped below a cent per ton-mile in 1898, to 9.88 mills, is now down to 9.47 mills. The passenger mile earnings were 2.251 cents in 1899, against 2.142 cents in 1898. The rate is affected by the large suburban and ferry travel at Oakland.

The conferences of Western presidents held in New York on January 9 was apparently treated by some of the papers as an unusual conference rendered necessary by recent or newly discovered wrongdoings on the part of the roads, which called for a lecture from Chairman Knapp. In point of fact, however, this meeting was simply a continuation of the series of conferences between the presidents and the Interstate Commerce Commission, which began a year ago and which are to be continued. The lines represented were the Atchison, Topeka & Santa Fe System lines; the Burlington System lines; the Burlington, Cedar Rapids & Northern; the Chicago & Alton; the Chicago & Northwestern System lines; the Chicago Great Western; the Chicago, Milwaukee & St. Paul; the Chicago, Rock Island & Pacific System lines; the Colorado & Southern; the Denver & Rio Grande; the Elgin, Joliet & Eastern; the Fort Worth & Denver City; the Great Northern; the Illinois Central; the Indiana, Illinois & Iowa; the International & Great Northern; the Iowa Central; the Kansas City, Fort Scott & Memphis; the Minneapolis & St. Louis; the Missouri, Kansas & Texas; the Missouri Pacific; the Minneapolis, St. Paul & Sault Ste. Marie; the Northern Pacific; the Omaha, Kansas City & Eastern and affiliated lines; the Oregon Short Line; the St. Louis & San Francisco; the St. Louis Southwestern; the St. Paul & Duluth; the Southern Pacific; the Texas & Pacific; the Union Pacific; the Wabash; the Wisconsin Central, and the Vicksburg, Shreveport & Pacific. The Western Trunk Line Committee was represented by Chairman H. H. Courtright and Chairman Martin A. Knapp represented the Commission. The roads present reaffirmed the pledges of the Executive Officers to the Commission in regard to the lawful conduct of all traffic and voted to abolish commissions on all tickets sold on or after February 1st; and a committee was appointed to confer with executive officers of lines not represented in regard to their co-operation in such action. The next conference will be held in New York, March 7th. Mr. Jeffery, who presided at the meeting, told a reporter at its close that the results had been quite satisfactory. The representatives present showed a marked spirit of conciliation for the purpose of the general good.

Mr. R. T. Greener, Commercial Agent of the United States, at Vladivostok, sends to the Department of State quotations from recent newspaper criticisms on the Siberian Railroad. The principal one of these articles, which is from the Sibirski Listok, shows evidence of more or less prejudice on the part of the writer, not to say ignorance. One of his criticisms has to do with heavy locomotives, which, on ascending grades and levels, damage the tracks because the rails are too light, while on descending grades they do harm "because it is impossible to control their speed." The material part of the complaint is that 36-lb. rails have been used and the work has been so hurried that the hills were not sufficiently cut down nor the valleys sufficiently filled up. The light rails will have to be replaced by heavier ones and trestle bridges will have to be replaced by more permanent structures before much business can be done over the road. Inasmuch as these conditions were, no doubt, fully foreseen by the Government, the value of the present criticism is not apparent. The second criticism is from another newspaper, the Dalny Vostok. In this it is stated that a good deal of the railroad line is laid on marshy ground, which will have to be abandoned for a new location higher and drier. Rails and other supplies were bought of Russian iron works at twice the price which the same articles would have cost in England. It is asserted that while the original estimate of the cost of the road was $18,000 a mile in Western Siberia and $25,750 east of Lake Baikal, the actual cost will be $34,505 a mile. The distance from St. Petersburg to Port Arthur will be 5,819 miles and from Berlin 6,331 miles. The journey from Western Europe to the Pacific Ocean will take two weeks, though when the road is improved this time can be reduced to 11 days. The writer points out that this continental railroad cannot compete with ocean carriage for freight from London to Chinese ports.

In the report of a collision on the Cheshire Lines near Manchester, England, Nov. 18, due to a failure of block working during a dense fog, the fact comes out that, at a certain busy signal cabin, the record-

ing of the passage of trains had been given up, because it could not be done without additional help. The number of trains passing during the 24 hours is about 500; and as the signalman had all he could do to signal the trains, the manager of the line decided that there was no need of keeping a record. Colonel Marindin, speaking for the Board of Trade, "strongly advises" the road to reconsider the matter and to resume the practice of booking, with the assistance of a boy. The employment of boys for this kind of work in signal cabins is common in England. In this collision two engines, coupled together, ran into the rear of a passenger train, and 35 persone were injured, 14 of them severely. The signalman appears to have depended (necessarily) on information given to him by a man on the ground, and in the questions and answers between these two men there was a mistake as to which one of two tracks was referred to. Colonel Marindin reminds the road that the collision could hardly have occurred if lock and block apparatus had been in use, which apparatus "has been found so useful and which is so rapidly coming into use on many of the railroads round London."

Mr. John D. Rockefeller, President of the Standard Oil Company, in his answers to questions propounded by the Federal Industrial Commission, published in the Washington Evening Star of January 10, says that his company has received no rebates or other discounts from the railroads since 1887. The season when rebates were most common was in 1877, '78 and '79, when most of the roads allowed 10 per cent. These rebates were, however, paid to all oil shippers alike. The only advantage enjoyed by the Standard Oil Company by reason of the rebates was the increase in the volume of its business, due to its ability to reduce the price of oil. In one case an agent of the Standard Oil Company accepted from a railroad a percentage on oil shipped by other refiners, but the company promptly repudiated the arrangement and refunded the money, which was less than $300. The Standard Oil Company, in accepting rebates from the railroads, furnished loading facilities and discharging facilities, and exempted the railroads from liability to fire. Mr. Rockefeller says that if it were not for the pipe lines, conveying oil cheaply to the seaboard, which were laid at an expense of $50,000,000, this country could not get remunerative prices for oil in foreign countries, and the wells would have to be closed.

In Baltimore one night last week a lecture was given by Mr. Auguste Faure, Chief Clerk to the President of the Baltimore & Ohio, on a brand new subject, "Passes; or the Beauties of Transportation." One of the principal charms of this address was the manner of its delivery and the pleasing personality of the speaker, and, therefore, we shall not attempt to report it for our readers. It will be sufficient to say that Mr. Faure is fully conversant wtih his subject, and told some plain truths about Congressmen and other deadheads. We feel compelled to conclude, however, that the lecture was in large degree a failure, for we do not find in the report of it, in the Baltimore Sun, that any souvenirs were distributed to the audience. So far as we have discovered in a long and eventful life, the only way in which to make a pass figure as one of the beauties of transportation is to get it into your pocket; and in this respect Mr. Faure did nothing at all for his hearers. There is no doubt that he had with him any number of pass-books of the potential value of hundreds of thousands of miles, but his heart appears to have been as cold as the north side of a refrigerator car in February. What is the use of having a lecture under such circumstances?

Long Span Bridges.

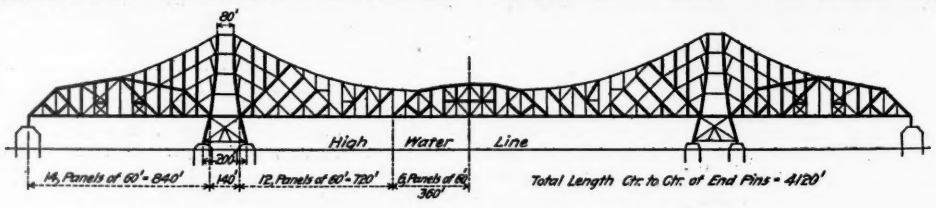
By Prof. W. H. Burr.

We find in the December Proceedings of the Engineers' Club of Philadelphia an important paper on "Long Span Bridges," by Prof. Burr, considerable extracts from which follow. Prof. Burr explains that he had not been able to find time for the analytical treatment of the subject which he hoped to give, but he gives "some, perhaps crude, ideas relating to long-span bridge design, in the hope that possible someone may be inclined to take up those portions of the subject which I have not been able to prepare for this evening. It is a very important subject for American bridge engineers at the present time, because we have come to that point in the engineering work of this country when bridges of unusual span must be built."

There are various resources of design by which multiple systems of bracing are eliminated, resulting in relatively large sections of metal concentrated in a few members; and whatever may be said about the stiffness of multiple systems of bracing connected at intersections, I think that what may be called the massive design of few members in our long-span bridges is a very excellent feature. It is not my purpose to make any observation in this connection which even would appear to be a criticism of multiple systems of bracing with riveted joints; but I think there is little difference of opinion, among American engineers at least, as to the best of the very long-span bridges now built being excellent examples of bridge design, and I believe, with scarcely an exception they are designed with single systems of bracing.

It is not my judgment that the single system long-span design, as found at the present time, has reached its limit of applicability, by any means. It would not be surprising to find spans within a few years reaching eight hundred feet or more in length; but in view of the working stresses which it is feasible to use, and with the metal which must be employed in such designs, I can see no reason at the present time to believe that that system of design can possibly be adapted to the great spans of from fifteen hundred to three thousand feet, which may be attained within a comparatively short time. I am speaking, obviously, from a point of view of such metal as we now have and can foresee in that part of the future which is within the reach of our observation.

All these non-continuous spans or other ordinary truss-bridge designs are, so to speak, self-contained. Their reactions are vertical, and there is no part of the structure outside of the immediate limits of the span; but it is a question, and a very serious question, whether that is the proper type of bridge for the longest spans which must be constructed in the future. It has been customary in the past to consider the cantilever as a type of structure which is well adapted to great lengths of spans, and to a certain extent that is true, but there is in the cantilever one serious defect. It is precisely that which we find in the simple noncontinuous span, and to which I have already adverted. There is altogether too much path to be traversed by the stresses. The cantilever is nothing more or less than the ordinary bridge truss made continuous over the piers and reaching back outside of the limits of the span to such distances as may be found advisable. We have the same chasing of stresses, so to speak, from one chord to the other, that is found in the ordinary truss bridge. In other words, the paths of stress from the points of application of the loading to the points of reaction are excessively long. There is that zigzagging across from one chord to the other and,



Design for a Cantilever Bridge over the Hudson River.

consequently, the placing of metal along these lines which we have in the ordinary truss and which is fatal to economy in all long spans. In addition to that, the cantilever possesses other economic disadvantages. Its reactions are both upward and downward, and that condition, together with the corresponding truss continuity, brings excessively heavy shearing stresses on web-members. It is fairly well adapted, however, to the lower lengths of long spans; and it is absolutely necessary if the truss form of construction is to be used where false works cannot be employed. The Forth bridge is the most marked instance of cantilever construction that has been completed, although it is not a design which would ever be imitated. Its proportions are very injudiciously taken, and there is failure to reach the degree of economy which ought to exist even in the cantilever.

In all the structures so far considered the compression member in the form of a long column plays a very important part. In fact, it predominates to such an extent that more than one-half of the weight of metal in the trusses is found in that form. That in itself, at first sight, might not appear to be very serious, but, as a matter of fact, it is a very serious feature of design. It involves the material reduction of working stress which must go with every long column, necessitating a much increased section over a tension member carrying the same load. One of the first steps in the development of the long-span bridge design must be such as will enable the metal to be used so as to give a high working stress together with very direct paths for the stresses from points of application of loading to the points of support. That may require a part of the structure to be outside of the limits of the span, which may appear disadvantageous. If those parts which are outside of the limits of the span are small, and can be made in such a way as to waste little material on details and be used with a high working stress, the economy will be very apparent—at least after a little consideration. Obviously, the simple tension member long enough to reach from one limit of the span to the other is a very economic member in itself if it can be made to do the work of the structure. It is obvious, also, that a compression member cannot be made to occupy such a condition simply because it does not tend to hold itself in position. It must be braced, if used in compression, precisely as in an ordinary truss. There are lengths of span under which compression members, as principal members, may be used to advantage; but I am now speaking of the longest long-span bridges.

The type of structure which meets the fundamental requirements which have been set forth in this rather elementary and crude manner is the stiffened suspension bridge. That structure has as its principal carrying feature a simple tension member stretched from one limit of the span to the other in a nearly vertical curve, and held at the tops of the towers by the backstays. The metal used in the cables may be such as to admit of the highest working stresses known to structural engineering practice. The ultimate resistance of wire suitable for cables is very high: certainly not less than 180,000 per sqaure inch at the present time, and it could probably be increased a third beyond that value with no sensible increase of cost. The main members of the structure are exceedingly simple, and so placed as to carry the stress in almost the shortest possible path that can be conceived of.

Since very high working stresses can be used, and since there are few main members of the structure, it is obvious that such a design would be utterly unfit for short spans. We should have members too light and flexible, and given to too much vibration; hence, they would be ill calculated to take moving loads.

Under the circumstances of shorter spans than those which are required for the longest crossings, we may use what is practically a stiffened suspension bridge turned over—i.e., with the cable displaced by a compression member—in other words, by the arched rib, which, in my opinion, is a form of structure that will be very much employed in the future. The arched rib is not adapted to every short crossing but for many crossings where the long-span feature is desirable, and where the conditions are such as to require a graceful, and at the same time stiff, bridge, it is an excellent structure. As a matter of fact, a stiffened suspension bridge and a stiffened arch are so nearly alike that precisely the same analysis will answer for both—that is, one may establish general formulae for the computation of stresses in the main members of the stiffened arch, and apply them directly to the stiffened suspension bridge, or vice versa. The stiffening truss may be continuous from end to end of the span, and be anchored down at each end, but in such a way as to permit horizontal movement at those ends, or it may be anchored down in precisely the same manner and be jointed at the center, as shown; or, again (what, in some ways, is a decided improvement), the joint at the center may be omitted and the stiffening trusses made continuous and carried back of the towers to be anchored down at their extremities. I think no such structure has been built; but such trusses have been designed. In that case there would be a point of support to the stiffening truss at the tower at each end. There would be rocking struts, extending down to such elevations as may be best suited to accomplish their purposes at both the towers and at the ends of the trusses, to serve as points of anchorage and of support. This type of stiffening truss has some advantages.

The old theory of the stiffening truss was such as to obviate the use of any equations which involved the elastic properties of the material. It virtually assumed that all the suspension rods and the cables were rigid, incapable of extension, and that the stiffening trusses themselves were without deflection under any condition of loading, making the problem one of pure statics. The fundamental equations of conditions from which the bending moment and the shears were computed, and by the aid of which all members were designed, thus involved in no way whatever equations of elasticity.

The modern system of stiffened suspension-bridge design is somewhat more advanced. It is of such a character that the stretch of the suspension rods, the stretch of the cables, the deflection of the stiffening trusses, and even the compression of the towers, if desired, are taken into consideration. The constant, horizontal component of stress in the cable is, or may be, determined on the condition that the total work of elastic distortion of all those members shall be the least possible. The equation or condition of least work, as it is called, is, so to speak, the elastic supplement to the ordinary equations of static equilibrium, necessary for a sufficient number of equations to determine all the unknown quantities of stress computation. It has been alleged in some quarters that even this theory is too loosely approximate to have any advantage over the old; that the suspension rods are of different lengths,

and consequently that they are stretched differently; that the deflection of the truss will not be quite as is assumed in the equations of the theory; that it is a question how much the towers will be compressed and how much the masonry; and, after all, inasmuch as we cannot reach a theory absolutely correct, there is little use in attempting such refinements at all. Such views, however, are in opposition to all progress. It is impossible to reach exact theory in any engineering work; but the ideal can be approached more and more, if we recognize the necessity and the advantage of doing it; and that is precisely what should be done in connection with this suspension-bridge theory.

In order that any type of suspension bridge may be made practicable, it is desirable, I think, that some other method of forming the cables should be devised than that of slowly weaving them, so to speak, as has been done in all cases of wire cables to the present time. The matter of an improved method of laying the cables has received a good deal of serious attention, and I have little doubt that cables may be designed to be laid with all the accuracy that is required for such structures, in possibly one-third of the time that has been required in the old manner of construction.

Probably the design of the cantilever was carried to as great a degree of excellence in the case of the proposed Hudson River structure as any yet reached (Plate B). The total length of clear span in this case was about 2,000 feet. It was proposed to put one pier in the Hudson River a thousand feet from the New Jersey side. The total weight of metal in that case was about 300,000,000 pounds. When this span was increased to 3,000 feet, the weight was increased to nearly 700,000,000 pounds—i.e., two and three-fourths times its original value. It is seen, therefore, that while it is feasible to construct a cantilever bridge of the length of span of 3,000 feet, it is not nearly so economic as the stiffened suspension bridge. The total weight of metal in the suspension-bridge span of the same length, including the towers, chains, and anchor-plates, was about 300,000,000 pounds. Adding enough viaduct structure on each end to make the total length equal to the total cantilever length, the weight of metal in the stiffened suspension system was materially less than half that in the same length of cantilever structure, and the probability is that under a more mature design the difference would have been greater in favor of the suspension-bridge system.

There is greater stiffness—i.e., less deflection for a given span—in the cantilever than in the stiffened suspension system, although the deflection of the latter is not serious. It is an open question just how far the simple, non-continuous span may be used with economy in competition with the cantilever; or, again, at what length of span the cantilever ceases to be as economic as the stiffened suspension-bridge system. The latter limit may be somewhere in the vicinity of 1,400 to 1,600 feet for highway spans, and possibly 2,000 feet for railroad spans.

Discussion.

John Sterling Deans: It may be of interest to the members to know that the Phoenix Bridge Company recently had occasion to compare the relative cost of cantilever spans with suspension bridges, and found the economic length of cantilever spans extended to at least 1,800 feet. This is with our present knowledge and experience of the cost of suspension bridges. The length may be somewhat reduced as we build more suspension bridges, but up to this time the economic length of the cantilever bridges extends beyond 1,800 feet. These computations were made by our designing engineer, a very careful and competent man.

Edgar Marburg: Engineers are doubtless agreed that for very long spans the suspension bridge is the only economically practicable form of structure. In the valuable report, made five years ago, by the Board of Engineers upon the proposed Hudson River bridge at New York—of which board Professor Burr was a member—comparative estimates indicated (a) that the cost of a 3,100-foot, clear-span, cantilever bridge was almost double that of one having a 2,000-foot clear span; and (b) that the cost of a 3,100-foot, clear-span, suspension bridge was less than one-third greater than that of the 2,000-foot cantilever bridge. The total length of the two structures was equalized by the assumed addition of viaduct approaches included in the estimates. While the above comparison is inclusive of substructure, the differences of cost are due almost wholly to the estimated differences in the cost of the superstructure.

In a paper read before the club some years ago, I stated that, for railroad purposes, the cantilever type of bridge seemed destined to occupy a field intermediate between that held by the simple truss for moderate spans—to about 600 feet—and that which would probably be covered by some form of suspension system, for spans exceeding 1,500 to 2,000 feet. While such figures, unless based on actual comparative designs under given conditions, can be regarded, at best, only as loosely approximate, it is seen that they agree substantially with those suggested by Professor Burr. The economic advantages of cantilever bridges compared with non-continuous ones for long spans, are due chiefly to the fact that their economic mean-depth is considerably less.

The Railroads of Peru.

Nothing can be a more evident proof of the general advance of trade and business in Peru, during late years, than the large increase on almost all the railroads, both in traffic and revenues, since the year 1890, when the Government lines were taken over by the Peruvian Corporation, this increase has been particularly accentuated since 1895, a short time after the extensions of the Central and Southern Railroads were completed to Oroya and Sicuani, respectively, and the benefits of the undisturbed internal affairs of the country began to be felt.

The following details, taken from the yearly reports—1895 to 1898—of the different companies suggest the development the country is capable of under normal and favorable conditions:

	Passengers carried.	Freight carried.	Gross revenue.		
1895...	2,553,931	432,378 Metric tons	£311,000		
1896...	3,034,108	484,939 " "	349,000	12.2%	increase
1897...	3,159,631	505,858 " "	353,000	1.15%	"
1898...	3,158,138	544,395 " "	374,000	5.96%	"

There is every probability that the country will pursue its progressive career in the years to come, as the feeble attempts at revolution that broke out at the last presidential elections has now been crushed, largely by the people themselves, and the personality of the President now in office offers every guarantee of a sound and stable administration.

Mr. E. L. de Romaña, elected President of the Republic for the period of 1899 to 1903, is a civil engineer of high professional standing; he was graduated in England and is an Associate Member of the Institution of Civil Engineers, and has been professionally engaged in Brazil and elsewhere. He belongs to one of the oldest and most distinguished families of Arequipa, and was elected rather on account of personal merits than as party leader.

Lima, December 15th, 1899. **

Patents.

In the discussion of patents, at the December meeting of the Western Railway Club, Mr. J. Snowden Bell, Patent Attorney, Pittsburgh, Pa., made a concise statement of the course it is well to follow in the earlier stages of invention, in order to stand in as safe position as possible in the Patent Office, in the event of a contest with another applicant making a claim to the same invention. Mr. Bell said:

The inventor is, in most instances, an unwilling party to a contest, known as an "interference," instituted for the purpose of determining which of two or more applicants is the prior inventor and entitled to a patent, and which is usually lengthy and expensive. It will therefore be readily seen that any preliminary precaution or measure of preparation which would tend to clearly establish the right of an inventor, in case he should be brought into an interference, is of importance and value to him.

Suppose that A, of Chicago, and B, of San Francisco, independently make applications for a patent for an improvement of any description, both claiming the same invention. If it be found by the Patent Office that the invention is novel and patentable, the question arises whether A or B is entitled to a patent, and, unless concession of priority is made by one party to the other, it must be settled by an interference, in which testimony may be taken on both sides, and which is determinable by the decisions of one or more tribunals of the Patent Office, or by the Court of Appeals of the District of Columbia, if carried to that court.

It is well settled, as a general principle of law, that he who first conceives an invention is entitled to priority, if he has proceeded, with reasonable diligence, to reduce the invention to practice. There are two forms of "reduction to practice" known to the law; one is termed "actual" reduction, and consists in constructing and operating a device or machine containing the invention, and the other, which is termed "constructive" reduction, consists in filing an application for a patent for the invention. "Actual" reduction to practice, as above defined, is stronger and more conclusive than "constructive," and should always be made as early as possible by the inventor, if in his power to do so. As soon as it is clear to him, as will be usually demonstrated by an "actual" reduction to practice, that the invention is complete and in practical form, he should make his "constructive" reduction or application for patent.

It is to be observed that the question of diligence is, in the most of cases, the vital one in an interference, and that therefore it does not follow that the inventor who was earliest, either in the date of his conception of the invention or of his reduction to practice, is necessarily the prior inventor in the eye of the law. If he is shown not to have been reasonably diligent, the party later in conception or reduction will be held to be entitled to the award of priority and to a patent for the invention.

Having the above general rules in mind, an inventor should in every case be particularly careful; first, to record and fix the date of every step which he takes in connection with his invention, from its conception to its reduction to practice; second, to make what has been above explained as an "actual" reduction to practice, just as soon as he possibly can; third, to satisfy himself that he has brought the invention to complete and practical form (by which is meant complete in all particulars except mere commercial sizes and proportions, which are supposed to be determined by those who are familiar with the art); fourth, to file an application as early as practicable after he has so satisfied himself. If his circumstances are such that he is unable to make an early "actual" reduction, he should work out the invention as fully as possible in the form of drawings and description, and make an application for patent ("constructive" reduction) as soon as possible. Every sketch, drawing, photograph or description relating to the invention should be dated and, if possible, witnessed by one or more persons who could, if necessary, verify the date, and it is a good plan for the inventor, as soon as the conception of the invention is complete in his mind, to make a sketch or drawing illustrating it sufficiently to make its general and ruling features plain, append a short description to the sketch, and have it dated and witnessed by two intelligent and reliable persons, upon whom he could call to testify as to its date, if it should become necessary, in the course of time, to do so.

In many instances within my observation, great delay and expense have been occasioned, and in some, the inventor's rights have been sacrificed, by the difficulty or impossibility of clearly proving dates of conception, drawings and sketches, disclosures of the invention to others, and other matters preliminary to reduction to practice, this being generally resultant upon a failure to record dates of these things at the time, and the inability of the inventor or his witnesses to accurately remember facts and dates, with no records to refer to, after the lapse of considerable time. The simple precautions above suggested will always be valuable, and sometimes essential, and they may be the means of saving the inventor from a protracted and expensive interference. Last, but not least, never file a "caveat." It is a delusion and a snare, conferring no protection whatever, involving a useless expenditure of time and money, and being positively prejudicial in leading the inventor to an unfounded sense of security, and putting him on record as not having completed his invention at the date of filing the caveat, when, as a matter of fact, the reverse may be the case.

TECHNICAL.

Manufacturing and Business.

On January 1, Mr. R. C. Hallett became associated with Julian L. Yale & Co., Chicago.

F. A. Kummer has been appointed Manager of the Eastern Paving Brick Co. of Catskill, N. Y., with offices in the Empire Building, New York City.

Ralph H. Chambers, Assoc. M. Am. Soc. C. E., and Frederic de P. Hone, Jun. M. Am. Soc. C. E., have formed a partnership under the firm name of Chambers & Hone, to act as consulting engineers. Offices have been opened at 60 New St., New York. Mr. Chambers has for the past four years been Consulting Engineer and Manager of the Boston office of the King Bridge Co. Mr. Hone has been connected for three years with the Southern Ry., recently as Assistant Superintendent in charge of the Norfolk & Asheville Division.

F. B. Howell & Co. of St. Paul, Minn., will represent the Pressed Steel Car Co. in St. Paul and vicinity.

Iron and Steel.

The Republic Coke Co. of Pittsburgh has recently bought 2,400 acres of coking coal lands in southern Fayette County for $549,585. It is understood that new coke works will be built at an early date.

Reports from the Schuylkill Valley, Pa., state that manufacturing plants are feeling the effect of the bituminous coal shortage. The E. & G. Brooke Iron Co. at Birdsboro and the Reading Iron Co. are temporarily closed.

Three thousand tons of rails were shipped from Baltimore last week to Port Arthur, China, for the Russian Government railroads.

During 1899 the States of Alabama and Tennessee made and shipped 1,571,570 tons of pig iron, of which Alabama forwarded 1,257,256. This is an increase of 20 per cent. over the highest previous year.

A company to be known as the Norway Iron & Steel Co. is being organized in York, Pa., to have a capital of $200,000. Chas. I. Ner is President; Chas. James of Philadelphia, Vice-President and General Manager; H. H. Webber, Secretary.

R. H. Sayre, Jr., has resigned as Assistant General Superintendent of the Pennsylvania Steel Co. He is succeeded by Archibald Johnston.

The plate and rail mills of the Danville Bessemer Steel Co. were damaged by fire Jan. 13. The plant was to have started the next morning after having been closed for several weeks.

Carnegie Interests in the H. C. Frick Coke Co.

At a meeting of the stockholders of the H. C. Frick Coke Co., held in Scottsdale, Pa., Jan. 10, four new members were added to the Board of Directors. They are D. M. Clemson, A. M. Moreland, James Gayley and Thomas Morrison, members of the Board of Managers of the Carnegie Steel Co., Ltd. Mr. H. C. Frick resigned as Chairman of the coke company and that office has been abolished. All the officers were re-elected.

James Gayley has been with the Carnegie Steel Co. for many years, being connected with the ore department. He was formerly manager of the Edgar Thomson furnaces. D. M. Clemson is in charge of the natural gas interests of the Carnegie Steel Co., and is also a member of the Board of Managers. A. M. Moreland is Auditor of the Carnegie Co. Last

month he was made a member of the Board of Managers of the Carnegie Co. Thomas Morrison, a cousin of Andrew Carnegie, was for some years Superintendent of the Duquesne Steel Works, but was transferred as Superintendent to the Edgar Thomson Steel Works.

A New Irish Express Engine.

A new compound express locomotive was recently put in service on the Belfast & Northern Counties Railroad of Ireland, being the design of Mr. Bowman Malcolm, locomotive superintendent of the road. The stroke of the engine is 24 in., diameter of high pressure cylinder 18 in., and low pressure 26 in. The drivings wheels are 7 ft. in diameter. The heating surface of the firebox is 106.07 sq. ft.; total, 1,153.6 sq. ft.; grate area, 18.25 sq. ft., and working steam pressure 170 lbs. per sq. in. The total weight is 101,900 lbs. The Walschaert valve gear, which has been adopted as standard by the designer and used on this engine, requires but one eccentric for each cylinder and leaves plenty of room for the axle journals, which in these engines are 11 in. long. The running speed between Belfast and Londonderry of a train of about 363,000 lbs. hauled by this engine is 43½ miles an hour, while the average maximum speeds are about 53 miles an hour and as high as 70 miles an hour can be reached. Although the grades are long and severe, the new engines recently put in service, including the one above described, handle the train with the greatest ease.

Block Signals on the Lehigh Valley.

The Lehigh Valley, which already has about 700 Hall automatic block signals, is to equip 98 miles more. The territory to be covered is between Falling Spring, Pa., and Van Etten Junction, N. Y., all double track. Between Falling Spring and Sayre both tracks will have the Hall disk signal, with a home and a distant signal on each post. There are to be 99 posts, having 99 home and 97 distant signals.

Between Sayre and Van Etten Junction, the Hall motor semaphore signal is to be used, and there will be a total of 17 posts, with 17 home and 15 distant signals. The average length of block will be 1.7 miles. The normal danger system will be used in both disk and semaphore signals.

THE SCRAP HEAP.

Notes.

The Lehigh Valley has taken off a part of the switching engines at Sayre and has reduced the force of yardmen.

The Delaware, Lackawanna & Western is putting electric headlights on 16 locomotives. This is the first railroad in the East to use these lights.

Near Bethlehem, Pa., on Jan. 11, the Central of New Jersey lost about $40,000 worth of oil and cars by a fire which destroyed 12 tank cars and a number of buildings.

The Atchison, Topeka & Santa Fe, on its new line to San Francisco, will plant willow trees along both sides of its roadbed for about 16 miles. The embankments to be treated this way are in swampy land where there is liability to damage from high water.

The Chicago & Northwestern has sued the Lake Street Elevated of Chicago for $300,000, claiming that its property at Fifth Avenue and Lake Street (its general offices) has been greatly depreciated in value by the building and operation of the Elevated road.

The Lake Shore & Michigan Southern has acceded to the request of the enginemen that all of the men in each class of the service shall receive the same pay. Heretofore the newer men in each class received about 65 cents per 100 miles less than those who had been running a year or two.

The Chicago, Burlington & Quincy has issued revised rules for watch inspection, to go into effect Feb. 1. Seventeen-jewel watches will be required, and they must have Breguet hair springs. Watches must be inspected every three months and must be registered by the inspector every week. An employe must not set his watch or in any way change its movements unless it runs down.

Philadelphia newspapers report that the Pennsylvania has increased the pay of yardmen at all the principal cities on its lines east of Pittsburgh. Enginemen, firemen, conductors and brakemen will receive increases of from one cent to two cents an hour. One paper says that the total increase in the payrolls, estimated by the number of men now employed, will amount to $400,000 a year.

A Railroad Along the Maderia River in Brazil.

Mr. K. K. Kenneday, U. S. Consul at Para, Brazil, calls attention to a project for a railroad from Santo Antonio do Maderia, which is at the head of navigation of the Maderia River, to run about 100 miles up the river and around its falls to Marmore. This would give access to the upper river and furnish an outlet to large portions of Bolivia through which country the river is navigable for hundreds of miles. Since Bolivia lost Cobija on the Pacific during the war with Chile, it has had no seaport. Could this road be built, it is believed that an extensive trade would be established between Bolivian and the United States and Europe. The road was first projected some 30 years ago. After the overthrow of the Brazilian Empire, the Republican Government gave the concession to an English firm. A company was formed, but, after some work, it failed, and all the material, including locomotives, rails, machinery, etc., was abandoned. A Frenchman who afterward obtained the concession also failed to build the road. It is stated that his interests can be bought at a low figure. Mr. Kennedy thinks that the Bolivian Government would grant a subsidy for the road. He refers to the report that an American syndicate, backed by Chas. R. Flint of New York, now has engineers on the ground investigating the advisability of completing the line.

Pressed Steel Car Company.

The Pressed Steel Car Company held its annual meeting January 9. In the statement of the President it was shown that the business of the company for the year 1899 amounted to $13,965,572. The total output was 9,624 cars, 127,656 bolsters and 50,926 truck frames. The orders on hand on January 1, 1900, to be executed during the year, amounted in money value to $16,596,863.

The net earnings for the year 1899 were $2,237,104, out of which a dividend of 7 per cent. on the preferred stock amounting to $875,000 was declared. A further dividend has been declared on the common stock of the company from the net earnings of the company equal to 6 per cent., or $750,000, one-quarter of which is payable on the 9th day of February, and the balance in quarterly payments on the 21st day of May, 20th day of August and 19th day of November, 1900. After all of these dividends are paid there still remains to add to the working capital of the company $612,103.85.

The orders on hand of $16,596,863 are all to be completed in June. This amount of work is more than the company did all of the past year. Instead of building 40 or 50 cars a day the company will build about 100 cars a day.

The common stock of the company earned 11 per cent. above the $875,000 paid out for dividends on the preferred stock. At the rate above stated the common stock of the company should earn at least 22 per cent. after the preferred dividends for the year 1900 have been provided for.

Eastbound Shipments for the Year.

Chairman J. F. Woffindin, of the Chicago Eastbound Freight Committee, has issued a statement showing the total quantities of flour, grain and provisions shipped eastward during the year 1899. This statement, like those issued each week, includes tonnage sent from Chicago and all points in Cook County, together with certain other junctions, to and beyond the western terminal of the Trunk Lines. The total was 5,707,148 tons, as follows:

	1899.		1898.	
Roads.	Tons.	Per Cent.	Tons.	Per Cent.
B. & O.	596,952	10.5	349,303	8.3
C., C., C. & St. L.	337,066	5.9	283,451	6.7
Erie	539,902	9.5	515,181	12.2
Grand Trunk	489,606	8.6	347,373	8.2
L. S. & M. S.	887,283	15.5	580,823	13.7
Mich. Cent'l.	655,006	11.5	552,629	13.0
N. Y. C. & St. L.	570,980	10.0	445,260	10.5
P., C., C. & St. L.	479,258	8.4	317,421	7.5
P., F. W. & C.	794,294	13.9	543,874	12.8
Wabash	356,801	6.2	301,205	7.1
Total	5,707,148	100.0	4,236,520	100.0

Flour and provisions moved in about the same volume as during 1898, and the great increase was chiefly in grain. In this the quantity in 1899 was 4,177,282 tons; in 1898 it was 2,744,983 tons.

Highway Bridge at Hamilton, Ohio.

The Wabash Bridge & Iron Works of Wabash, Ind., has recently finished a single span bridge over the Miameter River at Hamilton, Ohio. The bridge is a single span, camel back, Baltimore truss, 406 ft. center to center of end pins, with a clear roadway of 22 ft. and two 6-ft. sidewalks. The roadway is paved with asphalt blocks laid on buckle plate and concrete foundation. The sidewalks are concrete supported on steel I beams. No wood is used in its construction. The trusses are 26 ft. 6 in. center to center. The work was detailed, made and erected under the supervision of C. E. Howe, Chief Engineer of the bridge works, with W. B. Hinkle in charge of the erection. The sub-structure was built by Louthan & Shields of Hamilton. The cost of the entire structure was about $65,000.

The Galveston Terminal of the Southern Pacific.

The Southern Pacific Company has let contracts for the proposed improvements at Galveston, Tex., for which something like 6,000,000 ft. of square edge or dimension timber will be required. Of this, 2,700,000 ft. will be creosoted. There will also be used about 4,500 pieces of piling of different lengths. The greater portion of the piling will be creosoted.

The International Creosoting & Construction Co. of Beaumont, Tex., has the contract for creosoting part of this. Three large piers are to have steel sheds.

Tests of Illinois Coal.

The Department of Applied Chemistry of the University of Illinois is making tests of Illinois coals with special reference to washing. It seems probable that with a reduction in the sulphur ingredients, Illinois coals may be more largely used in the production of gas.

New Vessels for the Morgan Line.

A contract for four new steel vessels to be built by the Morgan Line for service between New York and New Orleans has been let to the Newport News Ship Building Co., and it is expected the ships will be in commission by the spring of 1901. The dimensions are as follows: Length over all, 406 ft.; breadth, moulded, 48 ft.; depth, moulded, to awning deck, 33 ft. 9 in.; gross tonnage, 4,665 tons; net tonnage, 2,905 tons. Each will have an electric light plant. The engines will be triple expansion with cylinders 33, 52 and 84 in. in diameter, 54 in. stroke.

The Chapsal Brake in Paris.

The French technical newspapers say that the Chapsal electro-pneumatic brake has been adopted for the equipment of the Metropolitan Railroad in Paris. It is expected that the service on that road will be very intense during the World's Fair next summer and the responsible officers have concluded that the Chapsal brake will answer their purpose better than any other. Of course it is unnecessary to say that we should have chosen the Westinghouse quick-action without the electrical application, which would have answered the purpose quite as well and would have been freer from accidents and irregularities of operation.

Concrete Steel Bridges for Puerto Rico.

Contracts for two concrete-steel bridges, to cost about $86,000, for the military road from San Juan to Ponce, Puerto Rico, have been let to Edwin Thacher of Paterson, N. J., by Capt. William V. Judson, Corps of Engineers, U. S. A., President of the Puerto Rico Board of Public Works. One bridge will be over the Jacaguas River at Juano Dios, and will be 404 ft. long; the other is 270 ft. and will cross the Guayo River near Ponce.

Northwest Land Tunnel, Chicago.

On Jan. 8 the last connection necessary to complete Section 3 of the new Northwest Land Tunnel was made between drifts 4 and 5 under Humboldt Park. This is the final connection in 12 miles of tunnel which is to increase the water supply of about one-half the city of Chicago and on which work was begun in November, 1895, the work having been described from time to time in these columns. The tunnel, 10 ft. in diameter, begins at a crib 2½ miles out in Lake Michigan and passes the shore line at the foot of Oak St. From there it runs southwesterly to Green St. near Grand Ave., where the 10 ft. tunnel divides. One branch runs more southwesterly to Center Ave., where a new pumping station is being built. The other or northwest branch, which has just been cut through, is 8 ft. in diameter and runs to Springfield Ave., where another pumping station is being built. The original estimate for the system, including tunnel, intake, pumping stations and machinery, was $5,000,000; but the actual cost as reported by the City Engineer will be about $4,071,000. The estimated capacity of the system is 200,000,000 gals. a day, but the stations are being equipped to handle 60,000,000 gals. a day each. It is expected that all sections of the new system will be entirely finished by Feb. 1, but water will not be turned into it until about Sept. 1, as the pumping stations cannot be completed until then.

Railroad Greenhouses.

A recent description of the greenhouses of the Chicago, Burlington & Quincy at Aurora, says that there are now seven greenhouses under 14,000 sq. ft. of glass. Here plants are grown for the decoration of grounds surrounding stations along the line, and it is said that 1,000 blossoms a day, mainly roses, are used on the dining cars of the road. The blossoms are shipped from Aurora each morning packed in ice, and are sent to Chicago, Lincoln, Neb., and St. Joseph, Mo., where they are distributed to the dining cars.

Chicago River.

Commissioner of Public Works McGann last week ordered the Chicago River cleaned from the lake to Bridgeport, and 300 owners of dock property received notice to put it in order. If owners of docks do not make necessary repairs it is proposed by the city to do the work at their expense. It is proposed to remove or replace all broken and decayed piling, to clean the center piers of bridges as well as possible and to remove all accumulations of waste and refuse. This is necessary not only to make the river front presentable, but also to insure the safety of foundations of buildings and docks along the river when the Drainage Canal is fully opened and the current reaches its full velocity. As soon as the full flow is permitted in the Drainage Canal the Chicago River is to be fully flushed out, the pumps at Fullerton Ave. on the North Branch being used to help this work. It is expected by the city officials that next summer excursion boats will be running on the river to and from the canal.

Hard Lines for Statesmen.

One of the most ubiquitous and conspicuous figures around the House wing of the Capitol yesterday was that of Col. John H. Carroll, of Missouri. Colonel Carroll is the chief lobbyist of the Chicago, Burlington & Quincy Railroad. He looks after the legislative interests of that corporation at three or four Western State capitals, principally Jefferson City and Des Moines, and is being congratulated for having secured the re-election of Senator Gear of Iowa. Colonel Carroll refers with great affection to nearly every member of the Missouri and Iowa delegations as "young man," and was particularly active among these delegations in the House corridors yesterday. It is said that within a few days he will be joined by the lobbyists of other railroads, the intention being to get legislation at this session to further postpone the enforcement of the law compelling the railroads to adopt uniform automatic car couplers. . . . The Republicans in the House are already beginning to feel uneasy. If they go against the railroads several of them fear the roads will beat them for re-election, and if they vote for the roads a greater number of them from the West fear that their constituents will retire them. Consequently the policy will be, it is thought, to keep the matter as quiet as possible so as not to stir up an agitation that will extend from Washington to the districts of timid members.—Washington (D. C.) Times.

Lake Notes.

At the Wyandotte yards of the Detroit Ship Building Co., on Dec. 30, the steel side-wheel steamer Tashmoo, built for the White Star Co., was launched. The steamer is similar to the modern Hudson River boats, and is 320 ft. long, over all, 72 ft. wide over guards and 13½ ft. deep. Her engines are triple expansion, inclined, and her speed is expected to exceed that of any lake vessel. The Tashmoo will run between Toledo, Detroit and Port Huron.

Technical Schools.

University of Chicago.—The thirty-first convocation of the University was held at Studebaker Hall, Chicago, on Jan. 2. In his report Dr. W. H. Harper, President, said that the total attendance in all the schools and colleges of the University during the year was 1,733, an increase over previous years. He also announced contributions and bequests to the University during the year ranging from $10 to $200,000 each, and amounting in all to about $400,000. Dr. Harper said that, as enough gifts had not been made to secure Mr. J. D. Rockefeller's conditional gift of $2,000,000, Mr. Rockefeller had extended for 90 days the time for securing the rest of the sum required. It is understood that plans of the new buildings above noted will be prepared at once and that the work of building will be begun as soon as possible. The convocation address was delivered by President Arthur T. Hadley, of Yale, whose subject was "Our Standards of Political Morality." After this address degrees were conferred.

University of Illinois.—The mechanical engineering department has recently completed tests at the locomotive water stations of the Peoria & Eastern Division of the Cleveland, Cincinnati, Chicago & St.

Louis between Indianapolis and Peoria. In each case data were obtained as to the cost of operation and maintenance and the quality of the water. When completed these tests are expected to show the relative cost of pumping water at locomotive water stations by steam, gas and electricity.

Traffic Notes.

The Courier, of Connellsville, Pa., reports the total quantity of coke shipped from the Connellsville region during the year 1899 at 10,129,764 tons.

Commissioner J. F. Goddard, of the Trunk Line Association, has notified commercial bodies and complaining shippers that a hearing will be held on Jan. 22, at which complaints concerning the new freight classification will be listened to.

New grain elevators built at Chicago during the past two years have increased the grain storage capacity of that city about 10 million bushels. The total capacity of public and private elevators in Chicago is now about 60 million bushels, an increase of nearly 50 per cent. in seven years.

The roads west of Chicago, as well as those in eastern territory, have held a number of conferences to agree on the abolition of ticket commissions; and, if we may judge by the strong and encouraging statements given out to the reporters, there is at present a more general determination to stop the payment of these commissions than has been known before for many months.

Chairman Knapp has not given up his conferences with railroad Presidents. The last one, which was held in New York City last week, was attended by the Presidents of the principal roads west of Chicago, and Mr. Jeffery, of the Denver & Rio Grande, who presided, tells the reporters that the meeting produced among the Presidents a marked increase of confidence in one another, and a willingness to conciliate for the general good.

The latest news from Chicago may be classed under Greeley's headline, "Important if True." It is to the effect that certain members of the Board of Trade are trying to have the rules of the Board amended so as to make the acceptance of rebates from railroads a misdemeanor punishable by severe penalties. It is said that the movement was started by shippers who for years have enjoyed cut rates, but have now lost their "pull."

The collector of internal revenue at New York City announces that the Attorney-General of the United States has rendered an opinion that bills of lading for freight going by railroad to points in Canada and Mexico need not bear the 10-cent revenue stamp required by the law on export bills of lading, but that the one-cent stamp, which is used on domestic bills of lading, will be sufficient. This reverses the action of the internal revenue department. The grounds of Attorney-General Griggs' opinion are not stated.

Chicago reporters assert that the railroads have for two or three months past been favoring certain shippers by giving them the benefit of "old billing." In other words, a new shipment would be billed as though it had started at some previous date, during the prevalence of lower rates; and it is asserted that the railroad men own up to having manipulated rates in this way. This week it is stated that suspicion is aroused by the fact that in the seven days to January 12 the Grand Trunk took more than 16 per cent. of the eastbound shipments out of Chicago, which is about three times its usual proportion.

At the hearing to be held by the Trunk Line Association next Monday, to consider inequalities in the new freight classification, complaints will be presented by shippers of rope, pumice stone, bags, jute, soap, provisions, machinery, confectionery, hardware, agate ware, starch, leather and other commodities too numerous to mention. Conferences of firms in each of these several lines of trade have been held in New York during the past week at the rooms of the Board of Trade and Transportation. Messrs. Vanlandingham, of St. Louis, and Trickett of Kansas City, are expected to be present at the hearing, also representatives of shippers from Boston and other cities. At a meeting of merchants in Boston a resolution was passed asking the traffic managers of the principal New England roads to attend the hearing in behalf of New England shippers, the claim being that the new classification works discrimination against the whole of New England and in favor of the rest of the country.

LOCOMOTIVE BUILDING.

The Newfoundland is having two engines built by the Baldwin Locomotive Works.

The Quebec & Lake St. John has prepared specifications for nine new locomotives.

The Atlantic Coast Line is having one locomotive built by the Balwin Locomotive Works.

The Schenectady Locomotive Works are building one engine for the Mexican International.

The Pittsburgh Locomotive & Car Works has an order for one locomotive for the Atlantic & North Carolina.

The Boston, Revere Beach & Lynn has placed an order with the Manchester Locomotive Works for two engines.

The Seattle & International has ordered one consolidation engine with 20 in. by 24 in. cylinders, to weigh 130,000 lbs. We are not informed as to the name of the builder.

We understand that the Colorado & Southern will place the order this week for the locomotives referred to in our issues of Dec. 8 and Jan. 5. Fifteen engines in all are wanted, but only eight or 10 may be ordered.

A contemporary prints a report that the Ontario & Lake Superior Co. has ordered several locomotives from the Baldwin Locomotive Works. The Baldwin Locomotive Works have no such order, and in fact we cannot find that there is a road of that name in existence.

The Grand Trunk will build, at its Montreal shops during the year, about 24 locomotives similar to those built last year and previously described. They will be simple mogul locomotives, with cylinders 20 in. by 26 in.; drivers, 62 in. in diam., and a total weight of 159,068 lbs., of which 135,408 lbs. will be on the drivers. The boilers will be of the extended wagon top type with a working steam pressure of 200 lbs. There will be 283 charcoal iron lap-welded tubes, 2 in. in diam. and 143 in. long. The fireboxes will be of steel, 120 in. long and 40⅛ in. wide. The tank capacity for water will be 4,500 gals. and the coal capacity 20,000 lbs.

CAR BUILDING.

The Southern is reported in the market for 150 coke cars.

The Florence & Cripple Creek is in the market for from 100 to 150 box cars.

The Monterey & Mexican Gulf intends to shortly place an order for 100 box cars.

The Kansas City, Pittsburgh & Gulf is getting prices on a few combination cars.

The Mexican International has ordered 100 gondola cars from the American Car & Foundry Co.

The New York, New Haven & Hartford has ordered 100 coal cars from Osgood Bradley & Sons.

The Chicago & Eastern Illinois has placed an order with the Mount Vernon Car Mfg. Co. for 10 caboose cars.

The Pennsylvania has placed an order with its Renevo shops to build 100 box cars of 80,000 lbs. capacity.

The Illinois Central has placed an order with the American Car & Foundry Co. for 500 coal cars of 80,000 lbs. capacity.

It is reported that the Colorado & Southern is in the market for coaches and cafe cars. We have no official information.

The Newburgh, Duchess & Connecticut has ordered one 60-ft. passenger car, for May 15 delivery, from the Jackson & Sharp Co.

The Southern Pacific is building at its Houston and Algiers shops 500 flat cars, all of which it is expected will be in service July 1.

The Seattle & International has placed an order for 100 flat cars of 70,000 lbs. capacity. We have no information as to who will build the cars.

The Chicago, Lake Shore & Eastern is about to order 150 steel hopper bottom coal cars of 100,000 lbs. capacity. The contract will probably be awarded to the Pressed Steel Car Co.

From 10 to 12 cars a week are being built by the Atlantic Coast Line at its own shops, and within the course of a few weeks work will be begun on 200 ventilated box cars of 60,000 lbs. capacity.

Press reports from Philadelphia state that the Philadelphia & Reading has ordered 2,950 freight cars. This covers orders placed by the road late in 1899 and noted in these columns at the time.

The Chicago & Eastern Illinois has asked car and bridge builders for bids on 500 steel cars of 80,000 lbs. capacity, to be built of structural steel from designs of the road. The bids will be opened Jan. 25.

We understand that the Great Northern of Canada will place orders about Jan. 20 for the passenger and freight cars noted in our issue of Oct. 6 last, the ordering of which has been postponed from time to time.

The Canada Atlantic has received material for 700 box cars of 70,000 lbs. capacity which are being built at its shops at the rate of four a day. The cars are being fitted with automatic couplers and air brakes and Bettendorf body and truck bolsters.

During the year, the Pacific Coast Co. will build at its Seattle shops 10 hopper-bottom coal cars of 60,000 lbs. capacity, and possibly later in the year 10 more of the same class will be built. The material for the first 10 cars was ordered some time ago.

Last week we stated that the Missouri, Kansas & Texas had placed an order with the American Car & Foundry Co for a lot of cars. This is not a new order and simply refers to a contract recently filed and covering cars ordered during last year.

The Chicago, Indianapolis & Louisville on Jan. 10 put in service a train of new cars on its day train from Chicago to Cincinnati. The cars were all built at the Lafayette, Ind., shops of the road and the train consists of a 60-ft. combination baggage and express car, a smoking car upholstered in Pantasote, a coach with high-backed seats and a combination parlor, cafe and observation car 68 ft. long and with six-wheel trucks. All the cars are fitted with every modern comfort and convenience and the entire train is heated by steam and lighted by Pintsch gas. The cars are painted dark green and have wide vestibules with a wide observation platform on the observation car.

Last week we stated that the Intercolonial of Canada had ordered 200 box cars from the Crossen Co. and 25 from the Rathbun Co. In addition to 275 ordered late last year from Rhodes, Curry & Co. These cars will be of 60,000 lbs. capacity and measure 35 ft. long, 8 ft. 11 in. wide and 6 ft. 11 in. high. The specifications call for steel axles, Simplex bolsters, National hollow and Sterlingworth brake beams, M. C. B. standard brake shoes, Westinghouse air brakes, Dunham door fastenings, M. C. B. draft rigging, fibre dust guards, M. C. B. journal boxes and journal box lids, Sparham roofing, M. C. B. springs, diamond frame trucks and cast iron chilled wheels 33 in. in diam.

The order for 18 cars for passenger service placed this month with the Pullman Co. by the Oregon Short Line and referred to in our issues of Dec. 22 and Jan. 5, was for seven coaches, three chair cars, three dining cars, three baggage cars and two mail cars. The mail, baggage and chair cars and coaches will all be 60 ft. long and the chair cars and coaches will have Scarritt reclining chairs and Scarritt seats. The dining cars will be 70 ft. long and will have 10 tables each. The interior finish of the coaches, dining and chair cars will be mahogany. The cars are for March and April delivery and will all be equipped with hammered iron axles, double plate bolsters, Kewanee brake beams, New York air brakes, Hewitt brasses, National couplers, Pantasote curtain material and Forsythe curtain fixtures, Harrison dust guards, Safety heating system, Fletcher journal box lids, Pintsch gas, steel platforms, Pullman wide vestibules, Empire roofs, Paige wheels and O. S. L. standard trucks draft rigging.

BRIDGE BUILDING.

ADRIAN, MICH.—We are told that Adrian Township puts up three iron bridges each year and now has 18 such structures and has that many more to build. Bids for the work are generally received the last of April. John Spielman, Clerk.

ALAMEDA, CAL.—Major W. H. Heuer, Corps of Engineers, U. S. A., San Francisco, Cal., will receive new bids until Feb. 10 for the double draw span bridge, approaches, etc., to cross the Tidal Canal at Fruitvale Ave., near this place.

AMITE CITY, LA.—Bids are wanted until Feb. 24 for a steel bridge over the Tangipahoa River. Edward Gooken, President of the Police Jury, Hammond, La.

ATLANTA, GA.—The Atlanta & Alabama Ry. Co. will need three steel bridges of an average length of 400 ft., and several small trestles on the proposed new railroad. L. E. O'Keefe, Secretary and Treasurer, Atlanta.
Local reports state that the Mayor in his message proposes a viaduct over the Whitehall-Peachtree RR. crossing.

BELLAIRE, O.—The new bridge to be built over the Ohio River by the Baltimore & Ohio between Bellaire, O., and Benwood, Pa., is estimated to cost $455,000. (April 14, 1899, p. 269.)

BRYANT, IND.—The Grand Rapids & Indiana has under consideration a new bridge at this place.

CHICAGO, ILL.—City Engineer Ericson has made a report to Commissioner McGann, on the various types of bridges that are most feasible to span the Chicago River at Division St., Clybourn Place, and Ninety-fifth St. Among the plans submitted is one for a bascule bridge operating about a fixed axis, which is recommended by Mr. Ericson as costing from $75,000 to $100,000 less than bascule bridges of some other types, and requiring less foundation. Plans along this line are to be made at once and submitted to the City Council.
The bridge work planned for this year by the Lake Erie & Western consists of building about 40 arches of concrete and abutments for 15 plate girder bridges.

CINCINNATI, O.—The Board of City Affairs Jan. 11 passed a resolution to build the proposed Harrison Ave. viaduct over the Baltimore & Ohio tracks, which will probably cost $250,000. The viaduct is proposed from State Ave. and Ernst St. on the west to Bernard St. near Harrison Ave. on the east. The Cincinnati Street Ry. Co. proposes to use it.

COCHRANE, N. W. T.—A new steel bridge will be built over the Bow River. J. T. Dennis, Deputy Commissioner of Public Works for the Northwest Territories, will receive bids at Regina, N. W. T.

COLORADO SPRINGS, COLO.—A franchise granted the Colorado Springs Transit Ry. Co. requires that the company shall build and maintain all bridges necessary on its right of way. Reports state that several structures will be required.

COLUMBUS, O.—The Columbus, Buckeye Lake & Newark Traction Co., reports state, has a franchise which requires the company to build a new bridge over Big Walnut River. A. J. Warner of Newark, O., is interested.

COOKS FALLS, N. Y.—The New York, Ontario & Western has recently let a contract to the Rochester Bridge & Iron Works for a steel bridge 310 ft. long over Beaverkill at a cost of $21,000.

COSHOCTON, O.—The County Commissioners have been petitioned for a bridge across the Muskingum River at West Main St.

DENVER, COLO.—A viaduct proposed from Colfax Ave. will, according to report, cost about $600,000.

DUBUQUE, IA.—Congress will soon be petitioned for authority to build a bridge across the Mississippi River at or near Eagle Point. The right to build a bridge at this place, granted some years ago, has expired by limitation. (Nov. 3, 1899, p. 766.)

ELGIN, ILL.—The bids received last month for two steel bridges have been rejected by the Council and new bids are wanted. (Dec. 8, 1899, p. 850.)

EXETER, N. H.—A bridge is proposed over Hampton River. Estimates have been prepared but work will not be begun until the Legislature authorizes it.

GENEVA, IND.—A steel bridge will be built across the Big Limberlost by the Grand Rapids & Indiana.

GRAFTON, ILL.—A bill is before Congress to extend the time to May 21, 1900, for beginning work on the railroad bridge across the Illinois River near Grafton.

GRAND RAPIDS, MICH.—A steel bridge, reports state, is proposed north of this place by the Grand Rapids & Indiana.

HOUSTON, TEX.—The City Council has been petitioned for a bridge over White Oak Bayou at Houston Ave.

HUDSON, O.—Reports state that the Cleveland & Pittsburgh (Pennsylvania Lines) will build a bridge across Tinkers Run to shorten the line between Hudson and Bedford.

KAMLOOPS, B. C.—The time for receiving bids for the bridge over the Thompson River at this place has been extended from Jan. 31 to Feb. 28. Copies of the specifications can be had from W. S. Gore, Deputy Commissioner, Lands and Works Department, Victoria, B. C., on payment of $20.

KINGSTON, ONT.—The Kingston & Pembroke Ry. is applying to the Dominion Parliament for permission to build an extension for which a bridge will be required across the Ottawa River at or near Bryson, Que. Messrs. Kirkpatrick & Rogers of Kingston are the applicants.

LAKEWOOD, O.—The city officers of Lakewood Hamlet will soon want bids for a steel bridge to carry the Nickel Plate Railroad over the Boulevard.

LUFKIN, TEX.—We are told that two or three bridges will be built in Angelina County, one for the Lufkin Land & Lumber Co., and one or two by the Southern Pacific.

MANCHESTER, MASS.—The town of Manchester has petitioned the Legislature to have the drawbridge rebuilt.

MARSHFIELD, MASS.—Reports state that the Plymouth County Commissioners have decided to build a new drawbridge in place of the present bridge over North River.

MEROM, IND.—Reports state that a bridge is proposed over the Wabash River near this place by Sullivan County, Ind., and Crawford County, Ill.

MURRAY HARBOR, SOUTH, P. E. I.—A steel bridge is to be erected over the South River at this place.

MURRAY, IA.—The Chicago, Burlington & Quincy will build a new bridge over the Grand River, according to report, in connection with straightening its lines between Creston and Murray.

OTTAWA, ONT.—The Ottawa Improvement Commission has $35,000 at its disposal for an iron bridge across the Rideau River at the foot of King St. to connect with Union St. in New Edinburg. (Sept. 1, 1899, p. 618.)

PITTSBURGH, PA.—Plans have been prepared for rebuilding the Pittsburgh, Cincinnati, Chicago & St. Louis railroad bridge at Try St. over the Monongahela River. To widen the main span from 260 to 367 ft. will cost about $322,200.

PORTAGE DU FORT, ONT.—Bids will be received by the Department of Public Works at Ottawa until Jan. 23 for the piers and abutments for the Portage du Fort Interprovincial Bridge at "The Narrows" over the main channel of the Ottawa River. A check for $1,500 must accompany each tender. E. F. Roy, Secretary.

READING, PA.—The four bridges for which the Philadelphia & Reading recently let contracts are to cross the Little Schuylkill River. They are: Bridge 10, four spans, 205 ft. 8 in.; bridge 11, four spans, 206 ft. 4 in.; bridge 12, four spans, 204 ft. 4 in.; bridge 13, one span of 150 ft. Bridges 10 and 11 are double-track bridges, and 12 and 13 are for one additional track. The first three are deck plate girder and the other is a through truss.

ROCK ISLAND, ILL.—The Rock Island & Peoria, we are told, will need a 60-ft. steel bridge over Coal Valley Creek at Coal Valley, Ill.; a 120-ft. steel bridge over a creek and highway at Bishophill, Ill., and a 56-ft. steel structure over a street and the canal at Toulon, Ill.

ROME, N. Y.—A new bridge is proposed over the Black River Canal at East Dominick St., according to report, at a cost of $14,000.

SAN ANGELO, TEX.—Estimates will be considered by the Commissioners' Court at the next meeting for a steel bridge across North Concho at the foot of Beauregard Ave., this place.

SANDUSKY, O.—Reports state that the Tiffin, Toledo & Sandusky (Electric) Ry. Co. proposes to build a bridge across the Sandusky Bay to reach Port Clinton. R. W. Brown and Richard Young of Washington, D. C., are interested.

SAVANNAH, N. Y.—We are told that the bridges proposed over Seneca and Clyde rivers, which are 300 ft. wide, cannot be built unless appropriations are made by the State. Addison P. Smith, Supervisor.

SCRANTON, MISS.—A contract will be let on March 5 for an iron and steel bridge across Black Creek in Jackson County, according to the plans and specifications on file in the office of Frank H. Lewis, Clerk.

SCRANTON, PA.—The ordinance for a viaduct on the south side of West Lackawanna Ave., over the tracks of the Delaware, Lackawanna & Western, which is estimated to cost $167,526, has been signed by Mayor Moir.

SPRINGFIELD, O.—We are told that the Ohio Southern RR. will let a contract for a deck girder bridge within the next 15 days.

STEUBENVILLE, O.—It is estimated that widening the Panhandle bridge over the Ohio River at this place from 323 ft. to 537 ft. will cost $463,300.

SYRACUSE, N. Y.—New bridges are proposed on Salina St. over the Oswego and Erie canals.

TORONTO, ONT.—The City Engineer has reported to the City Council that a steel bridge to replace the present wooden Shaw St. bridge will cost approximately $13,000.

The City Council is considering the advisability of rebuilding the Gerrard St. bridge and has two plans in mind—one to cost $24,000 and the other $47,000.

WARE, MASS.—The Railroad Commissioners are considering a bridge across the railroad tracks to eliminate the grade crossing on Knox Ave. Chas. E. Allen, Consulting Engineer, Worcester, Mass., may be addressed.

WASHINGTON, D. C.—The District Commissioners, it is said, will recommend the widening and strengthening of the aqueduct bridge in order to allow the Alexandria & Falls Church (Electric) Railroad to cross it.

WEST BAY CITY, MICH.—In addition to the viaduct proposed at Washington St. across the Michigan Central, another structure is proposed at Midland St. (Nov. 10, 1898, p. 785.)

WEST SENECA, N. Y.—The State Railroad Commissioners have decided that the grade crossing at Abbott Road and the Terminal Rv. of Buffalo shall be abolished. John S. Rockwell, West Seneca, may be addressed.

WHITEHAVEN, PA.—The Lehigh Valley has recently let a contract for a deck plate girder steel bridge 535 ft. long across the Lehigh River between Carbon and Luzerne counties on the main line. Joseph Handler of Wilkesbarre, Pa., will build the foundations, and the A. & P. Roberts Co. will supply the superstructure. The total estimated cost is $150,000.

WINTERTON, N. Y.—A contract was recently let by the New York, Ontario & Western to the Rochester Bridge & Iron Works for a 270-ft. steel bridge over Shawangnok Kill at $16,000.

YONKERS, N. Y.—A new bridge has been recommended by Samuel Cooper, Commissioner of Public Works, in place of the structure across Caryl Ave., which is owned by the New York & Putnam.

YORKVILLE, S. C.—A bill is before the Legislature to empower the Board of Commissioners of York County to build a bridge across Catawaba River.

Other Structures.

ALLEGHENY, PA.—Work will soon be begun on a new plant for the North Pittsburgh Foundry & Steel Co. on the former site of the Carlin Mfg. Co., on Market St. in the Ninth Ward, Allegheny. The new buildings will be of steel construction and will cost about $100,000.

BALTIMORE, MD.—Work will soon be begun by Roydhouse, Arey & Co., on the new warehouse for the Northern Central Ry. at Brown's wharf at Baltimore. It will be six stories high instead of four, as originally intended.

NEW YORK, N. Y.—Plans have been filed with the Building Department by the Edison Electric Illuminating Co. for its new power house which is to cost $809,000. The structure will occupy the entire block from First Avenue to the East River, and Thirty-eighth to Thirty-ninth Sts., and will be three stories high. The building will have a steel skeleton.

PILOT POINT, TEX.—The joint depot of the Texas & Pacific and the Missouri, Kansas & Texas at Pilot Point was destroyed by fire Jan. 7.

PITTSBURGH, PA.—The Baltimore & Ohio terminal facilities at the Water St. depot will be improved.

SCHENECTADY, N. Y.—Work will soon be begun on a building for the General Electric Co., near the main entrance to the works, to be used mainly for general offices. It will be 150 x 250 ft., and five stories high.

SHARPSBURG, PA.—Moorhead Bros. & Co. propose to put in eight additional puddling furnaces.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page xii.)

New York Railroad Club.

The subject discussed at the meeting January 18 was "Lubrication." Mr. Charles Miller opened the discussion.

Canadian Society of Civil Engineers.

The third of a series of lectures on The Transmission of Electrical Power was delivered by Prof. R. B. Owens, M. Can. Soc. C. E., at the January meeting of the Society, which was held on Thursday of this week.

Western Railway Club.

A meeting of the Western Railway Club was held Tuesday afternoon, January 16, at the Auditorium Hotel, Chicago. Mr. F. A. Delano, Superintendent of Motive Power of the Chicago, Burlington & Quincy, presented a paper, "What Does it Cost to Run Trains at High Speeds?" A summary of this paper is given on another page.

Following the discussion of Mr. Delano's paper, Mr. W. H. Edgar, President of the Dearborn Drug & Chemical Works, opened a topical discussion on boiler feed waters, their treatment and results.

Franklin Institute.

At the annual meeting Wednesday evening, Jan. 17, the first topic was by Mr. John Birkinbine, on The Engineering Features of the National Export Exposition, it being an informal report upon the work involved in designing and erecting the buildings; the character and installation of the power plant and of the electric lighting service. Messrs. O. M. Greene, Jr., and C. O. C. Billberg, Superintendents of those branches, contributed to the subject. Mr. Wm. E. Quimby of New York described the construction and application of the screw pump which he has devised as a rotary pressure pump. Professor Arthur J. Rowland made a supplementary communication upon the Deschler-McAllister Portable Photometer, describing some improvements lately added to the apparatus. Officers, managers and committeemen were elected.

The Engineers' Club of Philadelphia.

The twenty-first annual meeting of the club will be held on Saturday, January 20, at 8 o'clock p. m. The annual report of the Board of Directors and that of the Treasurer will be read. Mr. Francis Schumann, the retiring President, will deliver the annual address. The tellers will announce the results of the elections of officers for 1900, and of Dr. Coleman Sellers for honorary membership.

At the meeting held January 6, there were 72 members and visitors present. The Secretary announced the death of Dr. Edward H. Williams, active member, which occurred on December 21, 1899, and upon motion the President was requested to appoint a committee to prepare a suitable memorial for the club. Mr. William B. Wilson, visitor, presented biographical sketches of the professional careers of William Hasell Wilson and Herman Haupt.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—The Governor has appointed Thomas J. Knox a member of the Minnesota State Railroad and Warehouse Commission, succeeding Judge Ira B. Mills.

—Mr. Clifford Lewis, Jr., Supervisor of Bridges of the New York Central & Hudson River Railroad, and Miss Isabel M. Kernan, were married at the bride's home in Utica, N. Y., Jan. 11.

—Mr. Harvey Williams died recently at his home in Danbury, Conn., aged 79 years. He was Secretary and Treasurer of the Danbury & Norwalk Railroad in 1884, now part of the New York, New Haven & Hartford.

—Mr. R. P. C. Sanderson, Master Mechanic of the Norfolk & Western, is to go to the Atchison, Topeka & Santa Fe as Assistant to Mr. John Player, Superintendent of Machinery. The exact title of his office is not yet decided upon. It is conjectured that Mr. Sanderson's special work at first will be in organizing the piecework system.

—At the Technical Club, Chicago, a dinner attended by 12 prominent engineers was given on Jan. 13 in honor of Mr. Isham Randolph, Chief Engineer of the Drainage Canal. Mr. Randolph made a short address on the opening of the canal, and Mr. J. F. Wallace, Assistant 2d Vice-President of the Illinois Central, spoke of the necessity of a canal across the Isthmus of Panama to be built by the United States.

—Mr. J. D. Harris is the new Master Mechanic of the Northwest System of the Pennsylvania Co. at Crestline, O. Born Sept. 14, 1872, he entered the shops of the Pennsylvania Co. at Fort Wayne, Ind., as machinists' apprentice in October, 1888. He has served continuously with the company since that date as locomotive fireman, Motive Power Inspector, Assistant Road Foreman of Engines of the Western Division in February, 1899, and Assistant Engineer Motive Power of the Northwest System on December last. This position he left a month later to take his present one of Master Mechanic.

—Mr. Geo. J. Charlton, who on Jan. 1 succeeded his father, Mr. James Charlton, as General Passenger Agent of the Chicago & Alton, has grown up with the Alton under the tutelage of his father. He was born Sept. 9, 1859, and entered the service of the Chicago & Alton in 1875 as a messenger boy and junior clerk in the department of which he is now the head. He has served in every capacity in the Passenger Traffic and the Ticket Accounting departments and is thoroughly familiar with all the details of the passenger business. On March 14, 1885, he was made Assistant General Passenger Agent, the position he held at the time of his recent advancement.

—Mr. D. F. Crawford, the new Superintendent of Motive Power on the Northwest System of the Pennsylvania Company at Fort Wayne, Ind., has spent the entire 14 years of his railroad service with the Pennsylvania Co. He was born at Pittsburgh, Pa., Dec. 4, 1865, and was educated in the common schools and in the Pennsylvania Military Academy. He entered the Altoona machine shop as apprentice on Dec. 1, 1886, and has been successively inspector of the Testing Department at Altoona from 1890; Assistant Master Mechanic of the Fort Wayne shops from Feb. 1, 1892; and Assistant to Superintendent of Motive Power from July 1, 1895, until his recent promotion on Nov. 1, 1899.

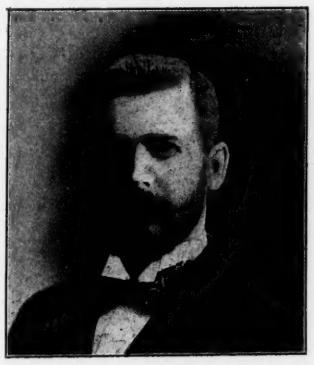
—Dr. Thomas Egleston died at his home in New York City on Monday of this week in his 68th year. Dr. Egleston was for years Professor of Mineralogy and Metallurgy in the Columbia School of Mines. He practically established the School of Mines at Columbia College in 1863; he originated the school and has been identified with it from the start. He was one of the founders of the American Institute of Mining Engineers and of the American Metrological Society. He has written much on metallurgy and mineralogy and has done much professional work outside of his writing and teaching. Dr. Egleston was born in New York Dec. 9, 1832, was graduated from Yale in 1854 and spent several years as a student in the Ecole des Mines in Paris. He was a member of the Century Club, of the American Society of Mechanical Engineers, and of various social, patriotic and scientific organizations.

—We have already announced the fact that the motive power department of the Great Northern Railway is abolished, and have noted some changes on that road consequent upon this step. As one consequence, Mr. J. O. Pattee is now foot loose. The duties heretofore performed by him will be divided through several other offices, part of them being done by the General Master Mechanic, part by the Division Master Mechanics, and part by the General Superintendent and the Division Superintendents. Mr. Pattee served 29 years on the Chicago, Milwaukee & St. Paul, 18 of which he was Master Mechanic of all divisions west of the Mississippi River. He has served 12 years on the Great Northern as Superintendent of Motive Power, all of this time with no vacation and working nearly every Sunday. Naturally, he feels now as if he could take a vacation. His present plan is to go to Paris and see something of the Exposition, but his arrangements for the future are not at all definite.

—Mr. Wm. Hassman, the new Superintendent of Motive Power of the Central Vermont at St. Albans, Vt., was born at Reading, Pa., Aug. 26, 1849. He entered railroad service with the Philadelphia & Reading as machinist's apprentice and continued with the company until 1877 successively as machinist, locomotive fireman and locomotive engineer. For the five years following he was with the St. Louis, Iron Mountain & Southern as roundhouse foreman at St. Louis, Mo. From 1882 he was General Foreman and Master Mechanic of the Richmond & Allegheny at Richmond, Va., until the absorption of that road by the Chesapeake & Ohio, when he became Master Mechanic of the western divisions. In October, 1891, he took service with the Newport News & Mississippi Valley as Superintendent of Motive Power of the Western Division; this division was later absorbed into the Illinois Central. On Feb. 1, 1899, as Master Mechanic with the Illinois Central, which position he held until his recent change.

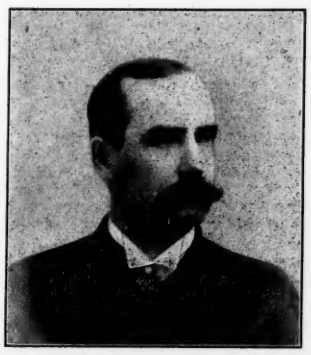
—Recent changes in the Galveston, Houston & Northern make W. W. Kent practically the managing head of that road. He was born at Peoria, Ill., Feb. 25, 1853. At 22 he was clerk in the freight office of the Toledo, Peoria & Warsaw, now a part of the Toledo, Peoria & Western at Peoria, Ill. Five years later he left that road as Chief Passenger Clerk to become for five years Traveling Passenger Agent of the Wabash, St. Louis & Pacific, now a part of the Wabash, at Peoria, Ill. For two years from 1885 he was Assistant General Passenger Agent of the Toledo, Peoria & Western; then, until 1893, General Passenger Agent of the Jacksonville Southeastern line at Jacksonville, Ill., and for two years more General Passenger Agent of the Chicago, Peoria & St. Louis. From 1895 to 1898 he was Chairman of the Southwestern Passenger Association at St. Louis. On May 1, 1899, he entered service with his present road, the Galveston, Houston & Northern, as Acting General Manager. Two months later the duties of General Freight and Passenger Agent were added. On Jan. 1 last the positions of General Manager and Acting General Manager were abolished and Mr. Kent was appointed Manager and continues to discharge the duties of General Freight and Passenger Agent.

—The new Freight Traffic Manager of the Missouri Pacific and the St. Louis, Iron Mountain & Southern, Mr. Wilmer C. Stith, was born in St. Louis, Mo., in June, 1858. He entered the service of the St. Louis, Iron Mountain & Southern as messenger in the general freight office in August, 1877, and held various clerical positions in that office, including that of Chief Clerk. In 1886 he became Assistant General Freight Agent of the entire system, with headquarters at St. Louis, Mo., at the same time acting as Assistant General Freight Agent of the freight traffic in and out of Memphis, Tenn. For two years from Jan. 1, 1890, he was with the Kansas City, Fort Scott & Memphis, the Kansas City, Memphis & Birmingham and the Current River roads as General Freight Agent. He returned to the Missouri Pacific on Jan. 1, 1892, as General Freight Agent and occupied that position until Dec. 18, 1899, the date of his recent promotion.



—Twenty years of continuous service with the Chicago & Alton is the record of Mr. C. H. Chappell, who retired from the position of Vice-President and General Manager of the road on Dec. 31 last. He becomes Receiver of the Omaha, Kansas City & Eastern, the Omaha & St. Louis and the Kansas & Northern Conecting, three roads which have been operated as the northern section of the Port Arthur Route. Mr. Chappell was born on March 3, 1841, in Illinois. His first railroad work was begun in August, 1857, as brakeman with the Chicago, Burlington & Quincy. He remained with that road 14 years, serving successively as baggageman, conductor, train dispatcher and Division Superintendent. Then for two years from July, 1869, he was Division Superintendent of the Missouri Pacific. For two years more he was General Superintendent of the Missouri, Kansas & Texas; then for one year General Superintendent of the Missouri Pacific. From Aug. 1, 1877, to Jan. 1, 1880, he was Division Superintendent of the Western Division of the Wabash. He then went to the Chicago & Alton of which road he has been Assistant General Superintendent, General Superintendent, Assistant General Manager, and since April 2, 1894, General Manager and Vice-President.

—After nearly 35 years of railroad service, Mr. T. E. Clarke on Jan. 1 last became General Manager of the Iowa Central. Born in 1849, he entered railroad service at 16 years of age as a telegraph operator. At 20 he was appointed Train Dispatcher of the St. Paul & Sioux City, now a part of the Chicago, St. Paul, Minneapolis & Omaha, where he remained five years. From there he went to the Santa Fe System at Topeka, Kan., where he spent one year as a clerk in the General Superintendent's office. Afterward he served in positions of Trainmaster, Master of Transportation and Superintendent of Transportation on the Mobile of Ohio and the Cairo & Vincennes, now part of the Cleveland, Cincinnati, Chicago & St. Louis. With this latter road he spent about seven years, while Captain Roswell Miller, now Chairman of the Board of Directors of the Chicago, Milwaukee & St. Paul, had the management of that property. In 1881 he returned to the Chicago, St. Paul, Minneapolis & Omaha as Assistant Superintendent. Two years later he took the position of Superintendent of the Minneapolis, & St. Louis under W. H. Truesdale, with whom he had been associated in the Omaha road. About three years later he was promoted to the position of General Superintendent, which position he held until leaving that road for his recent promotion. He was for several years prominently associated with the American Railroad Association, having been appointed a member of the first Committee on Car Service. Afterward he served two terms with the Committee on Train Rules and with the Joint Committee.



—The new Third Vice-President of the Chicago, Milwaukee & St. Paul, Mr. A. C. Bird, has been connected with that road for 17 years. He was born near Pittsfield, Pike Co., Ill., March 4, 1843. He served during the entire Civil War, first in Company B, Twenty-second Illinois Volunteer Infantry, and then in the Fourth Regiment of the U. S. Cavalry. He began railroad work in 1865 as a night watchman at Pana, Ill., for the St. Louis, Alton & Terre Haute. Later he served at the same station as truckman in the freight house, baggageman, ticket seller and chief clerk, and was called to the general office at St. Louis in 1871. In April the following year he was appointed Chief Clerk of the Freight Department of the St. Louis, Kansas City & Northern, now a part of the Wabash System, and in 1874 became its General Freight Agent. Upon the consolidation of the Wabash with the Kansas City & Northern under the title of the Wabash, St. Louis & Pacific, he was appointed General Freight Agent and subsequently Superintendent of Freight Traffic of the system. He entered service with his present company, the Chicago, Milwaukee & St. Paul, on Jan. 1, 1883, as General Freight Agent. Six years later he was made Freight Traffic Manager, and on Dec. 14, 1895, General Traffic Manager, the position which he held at the time of his recent promotion.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—R. P. C. Sanderson, of the Norfolk & Western, has been appointed Assistant to the Superintendent of Machinery on the Atchison. Precise title not yet announced.

Brainerd & Northern Minnesota.—A. Y. Merrill has been elected President, succeeding C. A. Pillsbury.

Buffalo, Rochester & Pittsburgh.—J. M. Floesch, heretofore Superintendent at Butler, Pa., succeeds Wm. E. Hoyt, resigned, as Chief Engineer.

Chattanooga, Augusta & Charleston Air Line.—The stockholders met at Augusta, Ga., Jan. 10, and made a number of changes in the Directors. The new officers are as follows: President, R. Lancaster Williams of Richmond, Va.; Vice-President, Chas. S. Heard, of Augusta, Ga.; Secretary, Boykin Wright, of Augusta, Ga., and Treasurer, Frank E. Fleming, of Augusta, Ga. (See E. & A., Dec. 8, 1899, p. 852.)

Chattanooga Southern.—J. T. Slatter, General Freight and Passenger Agent at Chattanooga, Tenn., has resigned.

Chesapeake & Ohio.—Jno. R. Gould, heretofore General Foreman of the Richmond shops, has been appointed General Foreman of the Huntington shops, succeeding A. G. Elvin. C. H. Terrell succeeds Mr. Gould at Richmond, Va.

Chicago & Alton.—F. G. Jonah has been appointed Engineer Maintenance of Way, with headquarters at Bloomington, Ill.

Chicago & Grand Trunk (Grand Trunk).—The Receivers of this company, H. B. Joy and E. W. Meddaugh, have made the following appointments: G. T. Bell, General Passenger Agent; D. Brown, General Freight Agent; Superintendent, W. Cotter; Auditor and Treasurer, J. H. Muir; Master Mechanic, J. E. Muhlfeld and Master Car Builder, J. Hodgson. All of these men held similar positions prior to the receivership.

Chicago & Northwestern.—W. H. Whalen has been appointed Division Master Mechanic at Baraboo, Wis., succeeding H. T. Bentley, transferred to Clinton, Ia., as Division Master Mechanic, succeeding J. Cockfield, resigned.

Chicago, Milwaukee & St. Paul.—F. W. Delbert, Master Mechanic at W. Milwaukee, Wis., has resigned. A. B. Bridges has been appointed Assistant General Freight Agent, with headquarters at Chicago, Ill.

Chicago & Northwestern.—C. S. Hall has been appointed Division Engineer of the Winona & St. Peter Division.

Colorado & Southern.—Charles Dyer, heretofore Division Superintendent of the A., T. & S. F., at Pueblo, Colo., has been appointed General Superintendent and F. E. Clary Superintendent of Telegraph of the C. & S. Mr. Dyer succeeds T. F. Dunaway, resigned.

Hocking Valley.—F. B. Sheldon, Chief Engineer, will also assume the duties of Assistant to the President.

Indianapolis Union.—O. H. Jackson has been appointed Master Mechanic, succeeding John Gordon.

Iowa, Minnesota & Northwestern (Chicago & Northwestern).—Herbert E. French, formerly Assistant Engineer at Keister, Minn., succeeds B. J. Sweatt as Assistant Engineer on Construction at Traer, Ia. (See RR. Construction column, Nov. 3, 1899, p. 769.)

Kohala & Hilo.—The officers of this company referred to in the Construction column are: President, Herbert B. Gehr, Honolulu, H. I.; First Vice-President, Dr. E. Tracy Bishop, Hagerstown, Md.; Second Vice-President and General Manager, Jaudon Browne, 1006 Betz Bldg., Philadelphia, Pa.; Secretary, Thomas Rain Walker, Honolulu, H. I.; Treasurer, Theodore Barrett, 1006 Betz Bldg., Philadelphia; Chief Engineer, John Cargill, Hilo, Hawaii; General Counsel, Dill, Bomeisler & Baldwin, 27-29 Pine St., New York; Representative in New York, Louis E. Bomeisler, 27-29 Pine St., New York.

Lake Erie & Western.—On Jan. 10, W. H. Newman (President of the Lake Shore & Michigan Southern) was elected President, C. F. Cox (Treasurer of the Michigan Central) Vice-President, Secretary and Treasurer, and F. Middlebrook (Assistant Treasurer of Michigan Central) Assistant Treasurer. The following were elected Directors: W. K. Vanderbilt, F. W. Vanderbilt, W. H. Newman, J. Pierpont Morgan and H. McK. Twombly. The position of Chairman of the Board held by F. W. Whitridge has been abolished. (See General RR. News column, Jan. 12, p. 30.)

Lake Shore & Michigan Southern.—S. K. Dickerson of the Norfolk & Western, has been appointed Master Mechanic of the Toledo Division of the L. S. & M. S., with headquarters at Norwalk, O., effective Feb. 1, and F. H. Greene Purchasing Agent, succeeding C. B. Couch, resigned, effective Jan. 15.

Lehigh Valley.—At a meeting of the stockholders, R. M. Gallaway was elected a Director, succeeding J. C. Strawbridge, resigned.

Linville River.—The officers of this company recently incorporated are: President, I. T. Mann, Bramwell, W. Va.; Vice-President and General Manager, W. M. Ritter, Columbus, O.; Superintendent, F. S. Hamlin, Kawana, N. C.; Treasurer, J. L. Hamill, Columbus, O., and Chief Engineer, N. L. Reynolds, Kawana, N. C. (See RR. Construction column, Nov. 10, 1899, p. 787.)

New Orleans & Western.—C. W. Towsley having been transferred, the duties of Traffic Manager have been assumed by Receiver and General Manager W. C. Dotterer. N. C. Carroll has been appointed General Freight Agent.

New York, New Haven & Hartford.—W. E. Barnett has been elected Third Vice-President.

Pennsylvania.—James Buckalew has been appointed Assistant Engineer Middle Division of the Philadelphia & Erie RR. Division, succeeding J. K. Johnston, who has been transferred to a similar position on the Schuylkill Division at Reading, Pa.

Pennsylvania Company.—At a meeting of the stockholders, R. B. Thompson was elected Treasurer of the St. Louis, Vandalia & Terre Haute. We are informed that there is no truth in the persistent reports that M. W. Mansfield has been appointed Assistant General Manager of the P. Co.

Pere Marquette.—The officers of this company, in addition to those mentioned last week (p. 29) are: Traffic Manager, A. Patriarche, Saginaw, Mich.; General Passenger Agents, George De Haven, Grand Rapids, and H. F. Moeller, Saginaw, Mich.; General Freight Agent, F. V. Davis, Grand Rapids; Assistant General Freight Agent, P. F. Gaines, Saginaw; Superintendent Car Service, David Crombie, Grand Rapids; Superintendents, J. K. V. Agnew, Grand Rapids, and W. D. Trump, Saginaw; Chief Engineers, J. J. McVean, Grand Rapids, and G. M. Brown, Saginaw; Superintendent of Track, John Doyle, Grand Rapids, Mich.

Pine Bluff Arkansas River.—W. H. Langford was elected President, to succeed John M. Gracie, resigned.

Pittsburgh & Lake Erie.—B. C. Vaughn has been appointed Assistant to the Vice-President.

Pullman Company.—W. H. Batterson has been appointed Superintendent at Philadelphia, Pa. Three districts have been established in Chicago with C. Lincoln as Superintendent of the first, A. W. Giltzow of the second and M. E. DuBois of the third.

Richmond, Petersburg & Carolina (Seaboard Air Line).—E. St. John has been elected Vice-President and General Manager of the R., P. & C., to succeed James S. Negley, resigned. (See RR. Construction column, Dec. 8, 1899, p. 853.)

St. Clair, Madison & St. Louis Belt.—John E. May having resigned, Wm. Graham has been appointed Superintendent and General Agent for the Receiver. Effective Jan. 11.

Texas & Pacific.—C. P. Fegan has been appointed Assistant General Passenger Agent.

RAILROAD CONSTRUCTION.
New Incorporations, Surveys, Etc.

BAY & COAST.—Thomas D. Riordan, Attorney for this company, has made application to the Board of Supervisors at San Francisco, Cal., for right of way for this proposed line from that city south about 100 miles to Santa Cruz. The company was incorporated June 22, 1899. L. H. Barnard and J. G. Hughes of San Francisco are among the incorporators. The estimated cost of the road is between $2,000,000 and $2,500,000. The attorney stated that franchises had been obtained for most of the right of way and that building would be begun as soon as the right of way is granted in San Francisco.

BIG SANDY & CUMBERLAND.—Senator St. Clair has introduced a bill into the Virginia Senate for a company with a capital stock of $100,000, to build a railroad from a point on the State line between Virginia and Kentucky, to run through the counties of Dickenson or Buchanan and thence through Tazewell County to the Clinch River, or to a connection with the Norfolk & Western.

BISMARCK, WASHBURN & FORT BUFORD.—President W. D. Washburn of Minneapolis, Minn., has filed a notice with the North Dakota Secretary of State to change the name of this company to the Bismarck, Washburn & Great Falls. The company's intention is to extend the line beyond Fort Buford through the Judith Basin to Great Falls, Mont. The road is now being built from Bismarck, N. D., northwest via Washburn, Coal Harbor and Fort Stevenson, and much of the grading is completed. (Nov. 10, 1899, p. 787.)

CANADIAN PACIFIC.—General Superintendent Leonard states that this company will spend $200,000 in improvements this winter and spring, including large increases in terminal and yard facilities of from 1,100 to 1,600 car capacity. At Toronto, Ont., a new 65-ft. turntable and new stores and sheds. At Smith's Falls new divisional offices are to be built to cost $6,000; also large new tea stores in addition to those already in use for the Orient trade at a cost of $11,000. The running of longer trains has necessitated the lengthening of sidings and $20,000 will be spent between Montreal & Toronto. The road will be re-ballasted between Chatham and Windsor and extra coal bunks will be built at Toronto Junction. The line from St. Anne's to Montreal Junction (20 miles) has been double tracked with the heaviest rails and the latest and best design of split switches and spring frogs have also been used.

Application will be made at the next session of the Dominion Parliament for power to divert the main line from Mission Junction, B. C., to New Westminster, thereby making New Westminster a main line point to Vancouver.

CHARLOTTE COUNTY.—A bill has been introduced into the Virginia Senate to incorporate this company, with a capital stock of between $2,500 and $50,000, to build a railroad from a point on the Southern in the county of Charlotte, to run northwest to Smithville and thence north to a point on the Norfolk & Western in the county of Prince Edward. Preliminary surveys are made. Among the incorporators are B. P. Eggleston of Smithville, Pa.

CHICAGO, DUBUQUE & OMAHA.—R. G. Struble of Toledo, Ia., Chief Engineer, is reported as saying that preliminary surveys are under way for this line from Dubuque, Ia., southwest about 300 miles toward Omaha, Neb. The headquarters are at Dubuque. B. E. Linahan of that city is President. (Dec. 8, p. 853.)

CHICAGO GREAT WESTERN.—Announcement is made that the company will spend about $750,000

during the year in improvements along the line between Des Moines, Ia., and Baxter, including heavy fills near East Peru.

CHICAGO, ROCK ISLAND & PACIFIC.—As to shortening the line between Drakesville, Ia., and Kansas City, Mo., an officer writes that the company is making surveys for a shorter line from Belknap, Ia., southwest to Trenton, Mo., to see if a route is practicable. (Jan. 5, p. 14.)

CINCINNATI SOUTHERN.—As to the proposed improvements, an officer writes that much exaggeration has been made by the press. A line 1¼ miles long is to be built around Tunnel 27 near Harriman, Tenn. In addition a contract has been let for an embankment reservoir dam at Cumberland Falls, Ky., to impound water from rainfall for a railroad water station. The new reservoir takes the place of a small one built in 1879. (Jan. 12, p. 29.)

CROW LAKE RY. & DEVELOPMENT CO.—Messrs. Teetzil, Harrison & Lewis of Hamilton are applying for an Ontario Act to incorporate a company to build a railroad from a point on White Fish Bay in the Lake of the Woods district of Rainy River east to a point on Crow Lake.

GREAT NORTHERN.—Surveys are reported in progress for an extension from Wenatchee, Wash., on the main line, to run north about 150 miles up the Columbia and the Okanogan to Oroville, and thence to Chesaw, tapping the Myers Creek mining district.

HARRISBURG & SOUTHERN.—Locating surveys are begun, according to report, for the section of this line from Harrisburg, Ill., to run west to Marion, connecting with the Illinois Central. Grading will be begun as soon as the surveys are completed. Seth F. Crews of Chicago is President, and S. S. Barger of Eddyville, Ill., a Director. (Oct. 20, 1899, p. 737.)

HILGARD, GRANITE & SOUTHWESTERN.—This company was incorporated in Oregon Jan. 5, with a capital stock of $60,000, to build a railroad 60 miles long from Hilgard, Ore., on the line of the Oregon Railroad & Navigation Co., to run south through Granite. Among the incorporators and officers are: Robert Smith, Manager of the Grand Ronde Lumber Co. (President), and J. M. Church, Cashier of the Le Grande (Ore.) National Bank. The central office is Le Grande. The route of this company is similar to that of the Hilgard & Granite, recently noted. (Dec. 29, 1899, p. 901.)

KAHOLA & HILO.—The route of this proposed line in the island of Hawaii is from Hilo, on the east side of the island, to run north and east along the coast to Mahukona and thence to Niulee. Surveys are being made for the entire route and bids will be asked for rails and rolling stock at an early date. No contracts are let yet for construction. The officers are given under Elections and Appointments. (Official.)

KANSAS CITY, FORT SCOTT & MEMPHIS.—Extensive improvements are being made on the Kansas City, Memphis & Birmingham line between Memphis, Tenn., and Birmingham, Ala. All bridges and trestles are to be filled in wherever possible and the 60-lb. rail is to be replaced with new 75-lb. steel. Of this about 40 miles is already laid.

KANSAS CITY, JOPLIN & LITTLE ROCK.—This company was organized at Joplin, Mo., Jan. 6, with a capital stock of $3,000,000, to build a railroad from Aurora, Mo., on the St. Louis & San Francisco, to run west 120 miles via Stoots City, Dueneweg and Joplin, Mo., to Galena, Kan., and westward. A considerable portion of the right of way is secured.

KINGSTON & PEMBROKE.—Application has been made to the Dominion Parliament for power to extend the line from Renfrew, Ont., across the Ottawa River to Bryson, Pontiac County, Que., and thence north to the eastern branch of the Ottawa River.

LAKE SUPERIOR & ISHPEMING.—An officer writes that there is no truth in the report that the company will build an extension west about 50 miles to L'Anse, Mich., and possibly to the copper district. (Jan. 5, p. 14.)

A preliminary survey is being made into some timber about 25 miles northwest from Presque Isle, Mich. It has not been decided whether the line will be built.

LEHIGH VALLEY.—The Council of Hazleton, Pa., has passed an ordinance granting the company permission to lay a spur on the west side of Locust St. to the property of the Anthracite Separator Co. at Elm St. and Fillimore Court.

Extensive improvements are reported in progress in the yards at Coxton, Pa., including the addition of eight or ten new tracks.

LIMA BELT.—This company was incorporated in Ohio Jan. 15, with a capital stock of $10,000, to build a belt line at Lima, O. The incorporators are: Chas. A. Matheaney, W. H. Duffield, W. K. Boone, F. W. Holmes and D. J. Cable.

LOUISVILLE & NASHVILLE.—A spur about 1,000 ft. long has been located at Reeder's Gap ore mines, Ala. The Tennessee Coal & Iron & Ry. Co. will grade the track, and the L. & N. will supply the ties and rails.

A spur track is being built to the furnaces at Gadsden, Ala.

MARSHALLTOWN & DAKOTA.—Surveys are reported in progress for an extension from Gowrie, Ia., to Rockwell City, about 20 miles. The line was recently completed from Fraser Junction to Gowrie, 19 miles. Hamilton Browne of Marshalltown, Ia., is President. (Nov. 24, 1899, p. 819.)

MISCELLANEOUS COMPANIES.—The Utah Construction Co., recently organized at Utah with a capital stock of $50,000, was incorporated Jan. 9 to build railroads, canals, etc. James D. Dee is President.

MOBILE & OHIO.—The City Council of Selma, Ala., has granted a franchise to this company for its proposed extension from Billingsley to run southwest about 15 miles to Selma.

NEW YORK, NORTH ADAMS & SPRINGFIELD.—This new company proposes to build a railroad from Troy, N. Y., to run east 28 miles via Brunswick, Grafton and Peterburg to Williamstown, Mass. Among those interested are men in North Adams and Springfield.

OHIO & LITTLE KANAWHA.—This company was incorporated in West Virginia Jan. 5, with a capital stock of $10,000, to build a railroad from Burnsville, Braxton County, to run northwest via Parkersburg to Zanesville, O. The principal office is Zanesville, O. The incorporators are Frank A. Durbin, J. Hope Suter, H. A. Sharpe, W. D. Schultz and H. B. Dick, all of Zanesville.

OSHAWA RY., BAY OF QUINTE RY., AND 1,000 ISLANDS RY.—R. C. Carter, General Manager of these three roads, is applying for a Dominion Act to extend the time for the completion of the main line and branches of these three roads.

PENNSYLVANIA COMPANY.—The Executive Committee has authorized the expenditure of about $300,000 on the Cleveland & Pittsburgh for double tracking the line between Hudson and Bedford, Pa., 4.7 miles, and also for changing the alignments and grades between those points.

PENNSYLVANIA ROADS.—The citizens of Clarion are raising a bonus of $50,000 to any railroad that will build a branch to that town. Negotiations have been made with the officers of the Allegheny Valley line of the Pennsylvania for an extension from Sligo. Another proposition is a branch of the Buffalo, Rochester & Pittsburgh from Falls City.

The line being built from the culm banks at No. 5, Stockton, Pa., to No. 6, reported as a Lehigh Valley branch (Dec. 29, 1899, p. 901), is by the Audenried Coal Co. Colliery No. 6 is just west and south of Stockton station. The L. V. is not interested in the branch.

PERE MARQUETTE.—An extension is to be made, according to report, from the Chicago & West Michigan line at Pentwater, to run north about 15 miles to Luddington.

PITTSBURGH & LAKE ERIE.—Extensive improvements are reported in progress in the yards at McKees Rocks, Pa., including seven extra tracks along the riverside which will more than double the capacity of the yards.

PORT ARTHUR, DULUTH & WESTERN.—Messrs. Blake, Lash & Cassels of Toronto are applying for a Dominion Act to enable purchasers of this road to incorporate a company to acquire complete control and operate or dispose of same with all its terminals, elevators, wharves, etc., at Port Arthur, Ont. This property is owned by the Canadian Northern.

PRINCE EDWARD ISLAND.—John W. McManus of Membramcook has the contract for grading the branch from Charlottetown toward Murray Harbor. (Dec. 29, 1899, p. 902.)

QUEBEC & SOUTHERN.—Messrs. Greenshields, Laflamme & Dickson of Montreal are applying to the Dominion Parliament for an act to incorporate the above company to acquire the United Counties Ry. and to build an extension from its terminus to Iberville, P. Q., thence to Lacolle, P. Q.; also a line on the said railway to Valleyfield, P. Q., on the St. Lawrence River.

ROCHESTER & ST. CLAIR.—This company was incorporated in Michigan Jan. 11, with a capital stock of $150,000, to build a line from Rochester on the Michigan Central, to run east 18 miles to Lenore on another branch of the M. C. The road is to be in operation July 1. Justin R. Whiting of St. Clair is President; Edward H. Parker, Detroit, Vice-President, and W. H. Acker of Lenore, Mich., Secretary and Treasurer.

ST. LOUIS, KANSAS CITY & COLORADO.—Contracts are to be placed in the early spring, according to report, for the proposed extension from Union, Mo., west toward Versailles. (Sept. 15, p. 650.)

SOUTHERN.—An officer writes that a survey has been made for the extension from Round Hill, Va., west about five miles to Snickersville, and the matter is being investigated, but he does not think, however, that the company woll build this year. (Jan. 12, p. 30.

SOUTHERN PACIFIC.—An officer writes that there is nothing in the report that the company is to build a spur from Cactus, Cal., to the Golden Cross mines. (Dec. 29, 1899, p. 902.)

SOUTH BROOKLYN.—This company was incorporated in New York Jan. 13, with a capital stock of $150,000, to build a railroad 12 miles long in the city of Brooklyn, to be operated by steam or electricity, from a point near Second Avenue and Thirty-ninth St., to run parallel to Thirty-ninth St. to the boundary line between the Eighth and Thirteenth wards and thence northeast to the eastern line of Kings County near Liberty Ave., in the Twenty-sixth Ward. The principal office is at Brooklyn. Among the incorporators are W. Bayard Cutting, 24 East Seventy-second St., New York; John F. Ambrose, 14 Henderson Place, New York, and J. Archibald Murray, 36 West Ninth St., New York.

SOUTH GEORGIA.—Application has been made in Georgia for an amendment to the charter, and in Florida for a new charter to build the proposed extension from Putnam, Ga., south 26 miles to either Madison or Greenville, Fla., on the Florida Central & Peninsular.

TEXAS SOUTHERN.—The company proposes to build a line from Harlton, Tex., to run west 10 miles to Asberry. (Official.)

WESTERN ALBERTA.—Messrs. Longbreed and Bennett are asking the Dominion Government for an extension of time for the commencement and completion of this road.

GENERAL RAILROAD NEWS.

ABERDEEN & ROCK FISH.—A mortgage has been made by the company to the Mercantile Trust Co., Baltimore, as trustee, to secure $50,000 of 6 per cent. bonds to build its extension from Raeford eastward. (Railroad Construction column, Oct. 6, p. 701.)

ATCHISON, TOPEKA & SANTA FE.—The stockholders of the Santa Rita line which runs from Whitewater Junction to Santa Rita, N. M., and of the Hanover line from Santa Rita to Hanover, on Jan. 11, by unanimous vote, authorized the sale of this property to the Atchison. (Dec. 29, p. 902.)

BALTIMORE & OHIO.—Holders of Mercantile Trust Company's certificates of deposit under the agreement of Sept. 28, 1898, for the reorganization of the Central Ohio, the Sandusky, Mansfield & Newark, the Columbus & Cincinnati Midland, the Newark, Somerset & Straitsville and the Pittsburg Junction are notified that they may receive new securities upon the surrender of their certificates of deposit to the Mercantile Trust Co., New York, after Jan. 15. (Oct. 13, p. 720.)

CHICAGO & ALTON.—A bill has been introduced into the New York Legislature placing the bonds of this company on the list of legal investments for savings banks.

CHICAGO, FORT MADISON & DES MOINES.—This property, which runs from Fort Madison, Ia., to Ottumwa, 71 miles, has passed under the control of the Chicago, Burlington & Quincy. The property was reorganized a year ago. (Jan. 27, 1899, p. 75.)

CHICAGO JUNCTION RAILWAYS & UNION STOCK YARDS.—The stockholders will vote Feb. 8 on a proposition to change the payment of dividends on the common stock to quarterly rather than semi-annual periods as at present.

CINCINNATI CONNECTING BELT.—Dick Bros. & Co. of Philadelphia are offering $100,000 of this company's first mortgage 5 per cent. gold bonds, due Jan. 1, 1929, at 102½ and interest. The bonds are guaranteed principal and interest by the Cincinnati, Portsmouth & Virginia. They are subject to call at 105 and interest.

COOS BAY, ROSEBURG & EASTERN.—Judge Bellinger, in the U. S. Circuit Court at Portland, Ore., on Jan. 10 appointed J. B. Hassett receiver of this line on suit brought by J. D. Spreckels & Bro. of San Francisco. (Dec. 29, 1899, p. 902.)

GALVESTON, HOUSTON & NORTHERN.—This property, formerly the Galveston, La Porte & Houston, has come under control, according to report, of the Southern Pacific.

GEORGIA & ALABAMA.—Judge Emory Speer of the U. S. Circuit Court at Macon, Ga., has granted a temporary injunction restraining this company from consolidating with the Florida Central & Peninsular or any other corporation. The question of making the injunction permanent will be considered on Jan. 24.

GULF & BRAZOS VALLEY.—The Texas State Railroad Commission on Jan. 8 authorized the issue of bonds by this company to the amount of $12,714 per mile for the 10½ miles completed between Peck City and Mineral Wells. (Railroad Construction column, Dec. 15, 1899, p. 871.)

LAKE STREET ELEVATED (CHICAGO).—The report of the Lake Street Elevated, Chicago, for the year 1899 shows a surplus of $3,639, against a deficit of $26,691 for the previous year. The average number of passengers carried daily in 1899 was 37,266, or 3,318 more than the year before, and the percentage of operating expenses to gross earnings was reduced from 51.30 per cent. in 1898 to 47.53 per cent. in 1899. The extensions of the road west have brought considerable new business, and during this year a third track (between the present tracks) will be laid west of Rockwell Street and used during rush hours for express trains. The following are the principal financial items of interest:

	1899.	1898.	1897.	1896.
Gross earnings....	$697,513	$633,403	$597,960	$573,668
Operat'g expenses.	331,553	324,947	329,124	339,382
Net earnings	$365,960	$308,456	$268,836	$234,286

MIDLAND TERMINAL.—The Farmers' Loan & Trust Co., New York, asks for sealed proposals up to noon Jan. 25, for the sale of a sufficient number of bonds to invest $17,988 of the sinking fund.

MISSOURI, KANSAS & TEXAS.—The absorption by consolidation of the Kansas City & Pacific has been consummated, and new stock is issued dollar for dollar for the stock of the K. C. & P. (Dec. 29, 1899, p. 902.)

The company has also issued $280,000 of 5 per cent. gold bonds due 1944, to complete the purchase of the Kansas City, Eldorado & Southern acquired last year. (K. C., E. & S., Nov. 10, 1899, p. 785.)

NORFOLK & SOUTHERN.—A meeting to consider the purchase of the Norfolk, Virginia Beach & Southern, called for Jan. 4, has been postponed to Jan. 22. (Dec. 8, 1899, p. 854.)

SEATTLE & INTERNATIONAL.—James Hamilton Lewis, on behalf of stockholders in New York and Canada of the old company, the Seattle, Lake Shore & Eastern, filed a bill in equity in the United States Circuit Court at Seattle, Wash., Jan. 15, asking for a receiver for the S. & I., and also an injunction against moving the books of the company. An examination into the accounts of the Union Trust Co. of New York, trustee, is also demanded.

SEABOARD AIR LINE.—The bill providing for the consolidation of various companies into one Seaboard Air Line system has passed both branches of the Virginia Legislature and has been signed by the Governor. (Oct. 27, 1899, p. 754.)

TACOMA & EASTERN.—Ladd & Tilton, bankers, of Portland, Ore., write with reference to a rumor as to change of ownership of this line, that it has not been bought by them but that a member of the firm has acquired a controlling interest in the etock. The road is five or six miles long and has been used to haul cord wood into the city of Tacoma. What will be done with it is undecided at present.

TEXAS & NEW ORLEANS.—The Atlantic Trust Co., New York, invites bids up to noon Feb. 2, for the sale of the Texas & New Orleans first mortgage bonds for the sinking fund to the extent of $82,500, at a rate not to exceed 110.

WESTERN MARYLAND.—The preliminary report of Expert Little, including the Western Maryland and its subordinate line, the Baltimore & Harrisburg, for the two fiscal years ended Sept. 30, 1898 and 1899, shows the following results:

	1899.		1898.
Gross earnings	$1,535,934		$1,398,395
Net earnings	532,318		408,266
Fixed charges	449,145		444,949
Balance surplus	80,130	(def.)	39,728